International Astronomical Union
Symposium 309

GALAXIES IN 3D ACROSS THE UNIVERSE

7 – 11 July 2014
Vienna, Austria

Scientific Organising Committee

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This issue: July 3, 2014

Book cover:

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Rationale

A new epoch with unbiased investigations of intrinsic properties of galaxies and their evolution has just started. High performance technology in 3D-spectroscopy in the optical/NIR regime and in radio interferometry allows for the first time the efficient mapping of stars, gas, and dust, in galaxies near and far. Detailed measurements of individual objects are complemented by surveys aiming at a full census of galaxies across the local Universe. Reaching out to the limits of the Universe, the evolution of spatially resolved properties is traced along the whole cosmic history. Likewise to these observational campaigns, new computer technology and highly advanced algorithms are exploited for detailed simulations to probe the underlying physical and cosmological connection.

In acknowledgement of this new dimension exploring galaxies and to foster new synergies, this IAU symposium 309 aims to bring together the optical and radio communities as well as theoreticians and simulators. A main theme will be to understand the performance of star formation relating its source and fuel to the necessary local physical conditions and processes as well as to the global influence by and its impact on the galaxy and its surroundings. Among the topics to be discussed are:

- The interplay between the gas and dust content and star formation in galaxies.
- Spatially resolved properties of gas, dust and stellar populations of galaxies, including their kinematics, distribution and evolution.
- Optical/NIR integral field spectroscopy and radio interferometry as well as the methods to analyze the growing complexity of the data.

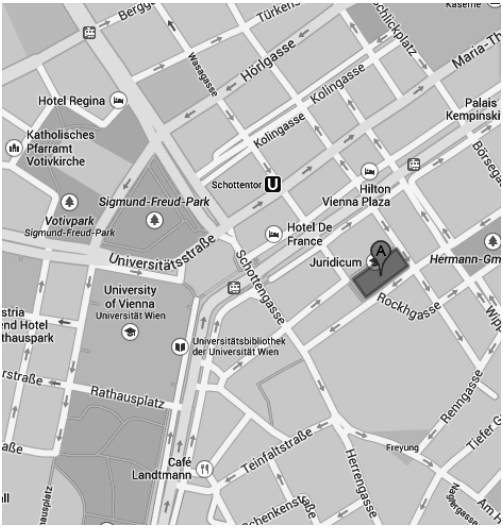
Conference Venue

The conference will take place at the main auditorium of the Faculty of Law ("Juridicum") of the University of Vienna. The presentations will be given in Hörsaal 10 (lecture hall 10) with ample space located in the basement, but with an exit to the outside.Around the lecture hall, coffee, cold drinks and snacks will be provided during morning and afternoon breaks, where you will also find the poster walls.

The address of the Juridicum is **Schottenbastei 10-16, 1010 Vienna** within the historical center of the city and close to the main building of the University of Vienna. Many hotels, restaurants and other attractions are within walking distance.

The nearest underground station is **Schottentor**. Besides the underground line U2, the following tram lines connect directly to Schottentor: D, 1, 37, 38, 40, 41, 42, 43, 44 and 71. Buses 1A and 40A also have their stops here.

For additional connections, please consult the `wienerlinien.at` website. We recommend buying the weekly ticket which costs EUR 15.80 and can be used any number of times within the main zone of Vienna (airport is outside of this area). The ticket can be bought online or directly at the dispenser machines located at each underground station.



Social Events

Welcome reception

The welcome reception will take place on Sunday, 6 July, from 18:00 to 21:00 on the top floor of the Juridicum. Food and drinks will be provided.

Conference dinner

The conference dinner will take place at restaurant **Kahlenberg**, located on top of the Kahlenberg mountain, which features splendid views of Vienna, the Danube and the Wienerwald.

Transportation to the location will be provided. Busses will pick us up at 18:30 in front of **Schottengasse 6-8** (in front of the Bank Austria building) and return to the same location after the dinner (possible departures at 22:30 and 23:00).

Observatory tour

We offer a tour of the University Observatory on Wednesday, starting at 20:30. Weather permitting, we will open the Great Refractor (70 cm diameter lens) to have a look at Mars, Saturn and/or the Moon. For directions to the Observatory, see below.

Public Talk

A talk targeted at the general public will be given at the University Observatory on Thursday, 10 July, at 20:00, by **Prof. Reinhard Genzel**. The title of the talk is "Massive schwarze Löcher und Galaxien". Note that this talk will be held in German.

The University Observatory is located at **Türkenschanzstraße 17** in the 18th district of Vienna. Take trams 40 or 41 from Schottentor and get off at stop **Aumannplatz** (6th stop). Walk to the far end of the square and up the street to the right (Türkenschanzstraße). At the first intersection, walk through the gates into the Observatory Park and follow the path up to the Observatory building.

Conference Programme

Monday, 7 July		
09:00	Bodo Ziegler	Welcome
09:15	Virginia Trimble	How Interferometry has Informed Our Knowledge of Galactic Structure: from Ryle's Aperture Synthesis to ALMA
09:45	Baerbel Koribalski	The Local Universe: Galaxies in 3D
10:15	Ray Sharples	KMOS at the VLT: Commissioning and Early Science
10:35	Barry F. Madore	TYPHOON
10:50	*Coffee & Poster Viewing*	
11:20	Martin M. Roth	Characteristics and Scientific Impact of 2nd Generation 3D Spectrographs in the Visual (MUSE, VIRUS, etc.)
11:50	Richard McDermid	Mapping Star Formation Histories of Early-Type Galaxies with the Atlas3D Survey
12:05	Lisa Young	The Recent Evolution of Early-Type Galaxies, as Seen in their Cold Gas
12:25	Olga Silchenko	Inner polar ionized-gas disks and properies of their host galaxies
12:40	*Lunch Break*	
14:10	Charles Lada	Schmidt's Conjecture and Star Formation in Galactic Molecular Clouds and External Galaxies
14:40	Alexia Lewis	The Spatially-Resolved Star Formation History of the M 31 Disk from Resolved Stellar Populations
14:55	Eva Schinnerer	Gas, Dust and Star Formation in the Whirlpool galaxy

15:15	Kevin Xu	ALMA Explorations of Dense Warm Molecular Gas and Cold Dust in Nearby LIRGs
15:30	Angel Lopez-Sanchez	Ionized and neutral gas in the XUV discs of nearby spiral galaxies
15:45	George Heald	The WSRT HALOGAS Survey
16:00	*Coffee & Poster Viewing*	
16:30	Santiago Arribas	An IFS survey of local luminous star forming galaxies: Ionized gas outflows and global ISM kinematics
16:45	Marc Sarzi	Gas Flows in Early-Type Galaxies
17:00	Matteo Barnabè	Dissecting the 3D structure of ellipticals with gravitational lensing and stellar kinematics
17:15	Maximilian Fabricius	Revisiting the stellar counter rotation in NGC 3521, NGC 7217 and NGC 7331 with VIRUS-W
17:30	*Highlight Talks*	
	Eric Hooper	Optimizing Signal-to-Noise and Spatial Resolution in 3D Spectroscopy with the WIYN Observatory's New Unique Multi-fiber Size IFUs
	Annie Hughes	Giant molecular cloud properties are influenced by galactic environment
	Sergio Torres-Flores	A kinematic analysis of the giant star forming regions of N11
	Sylvia Ploeckinger	3D chemo-dynamical simulations of Tidal Dwarf Galaxies
	Tom Richtler	The nature of isolated elliptical galaxies
	Agnieszka Rys	Dwarf ellipticals in the eye of SAURON: dynamical and stellar population analysis in 3D
	Marja Seidel	Extragalactic Archeology: dissecting galactic bulges in space and time
	Caroline Foster	Metallicity Gradients in the Outer Halos of Massive Early-type Galaxies from 3D Spectroscopy
18:10	*End*	

Tuesday, 8 July		
09:00	Sebastian F. Sanchez	IFU Surveys, a panoramic view on galaxy evolution
09:30	Roberto Cid Fernandes	Resolving galaxies in time and space: Methods, uncertainties & results
09:50	Rosa Gonzalez Delgado	The Star Formation History of Galaxies in 3D: CALIFA Perspective
10:10	Polychronis Papaderos	Extended nebular emission in CALIFA early-type galaxies
10:25	Chung-Pei Ma	The MASSIVE Survey: an IFU Study of the Most Massive Galaxies within 100 Mpc
10:45	*Coffee & Poster Viewing*	
11:15	Stephane Courteau	The Structure and Scaling Relations of Spiral Galaxies
11:45	James Allen	The first 1000 galaxies of the SAMI Galaxy Survey
12:00	Lisa Fogarty	The SAMI Galaxy Survey: Probing the Evolution of Early-Type Galaxies through Stellar Kinematics
12:15	Michaela Hirschmann	The stellar accretion origin of abundance gradients in massive galaxies at large radii
12:30	*Lunch Break*	
14:00	Daniela Calzetti	The Scaling of Star Formation: from Molecular Clouds to Galaxies
14:30	Loretta Dunne	Evolution of gas and dust over the past 5 billion years
14:45	Denis Burgarella	Dust attenuation, star formation rate density at $0 < z < 4$ and 3D spectroscopy onboard the WISH wide-field 1–5 μm telescope
15:00	David Fisher	Extremely High Gas Fractions in Clumpy, Turbulent Disks at $z = 0.1$
15:15	Moses Mogotsi	Connecting Galaxy Dynamics with Star Formation using WIYN SparsePAK and WiFeS

15:30	Lodovico Coccato	Disentangling kinematics and stellar populations in counter-rotating galaxies
15:45	*Coffee & Poster Viewing*	
16:15	*Highlight Talks*	
	Alessia Moretti	Kinematics of superdense galaxies in clusters
	Michael Hilker	A 3D view of the Hydra I cluster core - I. Kinematic substructures
	Carlos Eduardo Barbosa	A 3D view of the Hydra I cluster core - II. Stellar populations
	Evelyn Johnston	The Transformation of Spiral Galaxies into Lenticulars
	Pavel Jachym	Molecular gas and inefficient SF in intra-cluster regions of a ram pressure stripped wake
	Rory Smith	The Effects of Harassment on Early Type Dwarfs – Sensitivity to Orbital Parameters
	Peter Erwin	Using 3D Spectroscopy to Understand the Relationship Between Classical Bulges, Pseudobulges, and Supermassive Black Holes
	Remco van den Bosch	Super-Massive Black Holes in Compact Galaxies
	Mischa Schirmer	Quasar ionization echoes and 100,000 year baseline AGN light curves
	Christian Maier	The mass-metallicity and fundamental metallicity relations at $z \sim 1.4$ using VLT-SINFONI near-infrared spectroscopy of zCOSMOS galaxies
	Junko Ueda	Investigating the evolution of merger remnants from the formation of gas disks
17:10	*End*	

Wednesday, 9 July		
09:30	Jeff Kenney	The influence of ram pressure on galaxy evolution and the multiphase ISM
10:00	Rose Finn	The Local Cluster Survey: Probing Gas Stripping in Nearby Galaxy Groups and Clusters
10:15	Bruno Rodriguez Del Pino	OMEGA: OSIRIS Mapping of Emission-line Galaxies in A 901/902
10:30	Claudia Mendes de Oliveira	3D studies of galaxies in groups and other interacting systems
10:50	Katherine Alatalo	Interplay between CO and [CII], and the suppression of SF in Compact Group galaxies: a Herschel and CARMA view
11:05	*Coffee & Poster Viewing*	
11:35	Françoise Combes	Models of AGN feedback
12:05	Thaisa Storchi-Bergmann	Feeding and feedback in nearby active galaxies tracing co-evolution of SBMHs and galaxies
12:25	Toshiki Saito	Investigating AGN/SB activities through ALMA multi-line observations in the mid-stage IR-bright merger VV114
12:40	Leonard Burtscher	Possible evidence for the disappearance of the AGN torus at low luminosities
12:55	Michael Dopita	The Siding Spring Southern Seyfert Spectroscopic Snapshot Survey (S7): Probing the Physics of Seyfert Galaxies using their Extended Narrow-Line Regions
13:15	Tiantian Yuan	The Beauty and the Beast at the Core of a X-ray Luminous Cluster
13:30	*End — Free afternoon*	

Thursday, 10 July		
09:00	Philip Hopkins	Galaxies on FIRE: Stellar Feedback Explains Inefficient Star Formation
09:30	Desika Narayanan	The Star Forming Molecular Gas in Galaxies Near and Far
09:45	Fréderic Bournaud	Disk galaxies at high redshift: dynamics, star formation, and feedback processes
10:05	Noelia Jimenez	Chemical enrichment by SN Ia in hydrodynamical simulations: different progenitor scenarios
10:20	I-Ting Ho	Dissecting Galactic Winds in Star-forming Galaxies
10:35	*Coffee & Poster Viewing*	
11:05	Reinhard Genzel	Star Formation at the peak of the galaxy formation epoch
11:35	Natascha M. Förster Schreiber	Galaxy growth at early times from 3D studies
11:55	David Sobral	The dynamics and evolution of H-alpha star-forming galaxies since $z = 2.23$ with KMOS and SINFONI
12:10	Thierry Contini	The growing processes of galaxies at high redshift: lessons from MASSIV and prospects with MUSE
12:25	Giovanni Cresci	Blowin' in the wind: both 'negative' and 'positive' feedback in an outflowing quasar at $z \sim 1.6$
12:40	Stijn Wuyts	Resolved stellar populations and the mass distribution within galaxies since $z \sim 2.5$
12:55	*Lunch Break*	
14:15	Lisa Kewley	Galaxy evolution in 3D: near and far
14:45	Asmus Böhm	The IFU View on Distant Disks: the Good, the Bad, and the Most Massive
15:00	John Stott	The KMOS Kinematic Survey: The resolved Dynamics, Star-Formation and Chemical Properties of $z = 1 - 1.5$ galaxies

15:15	Eva Wuyts	KMOS-3D: The Evolution of Resolved Kinematics and Star-Formation from Redshift 0.7 to 2.5
15:30	Tucker Jones	Multiwavelength resolved spectroscopy of star forming galaxies at $z = 2 - 3$
15:45	Matthew Bayliss	Probing Individual Star Forming Regions Within Strongly Lensed Galaxies at $z > 1$
16:00	*Coffee & Poster Viewing*	
16:30	Mark Swinbank	ALMA surveys of high-redshift sub-mm galaxies
16:50	Tadayuki Kodama	Mapping and resolving galaxy formation at its peak epoch with Mahalo-Subaru and Gracias-ALMA
17:05	Helmut Dannerbauer	An Excess of Dusty Starbursts at $z = 2.2$
17:25	*Highlight Talks*	
	Miroslava Dessauges-Zavadsky	Molecular gas, stellar and dust content in typical L_* galaxies at $z = 1 - 3$
	Minju Lee	Jansky VLA S-band view of dusty starburst galaxies towards a protocluster surrounding 4C23.56 at $z = 2.48$
	Rene Fassbender	The formation of massive galaxies in the densest X-ray cluster environment at $z \sim 1.6$ as seen with 3D-Spectroscopy
	Ricardo Demarco	Early-type galaxy formation: understanding the role of the environment
	David Wilman	Tracking galaxy growth with KMOS^{3D}
	Renyue Cen	Physics of Galaxy Color Migration
	Anne Verhamme	Mock IFU observations of Lyman-alpha blobs, and Lyman-alpha halos around virtual galaxies
	Carlos López-Sanjuan	J-PAS: low-resolution ($R \sim 50$) spectroscopy covering 8500 deg^2
	Juan Macias-Perez	NIKA2: a dual band KID based camera for mm wavelengths
18:10	*End*	

Friday, 11 July		
09:00	Linda Tacconi	PHIBSS: Molecular Gas, Star-Formation and Scaling Relations at High Redshift
09:20	Roberto Decarli	A molecular scan in the Hubble Deep Field North
09:35	Rebecca Williams	The nature and assembly of primeval galaxies revealed by ALMA
09:50	Joaquin Vieira	High redshift starburst galaxies revealed by SPT, ALMA, and gravitational lensing
10:10	Wendy Williams	Deep imaging with LOFAR and the the accretion history of AGN
10:25	Leah Morabito	Discovery of Carbon Radio Recombination Lines in M 82
10:40	*Coffee & Poster Viewing*	
11:10	Thorsten Naab	The cosmological formation of massive galaxies
11:40	Rhea-Silvia Remus	Formation of disc galaxies in the Magneticum Pathfinder simulations
11:55	Jorge Moreno	Virtual IFUs: The spatial location of star formation in simulated merging galaxies
12:10	Tobias Goerdt	Cold streams: detectability and characteristics
12:25	*Lunch Break*	
14:00	François Hammer	Galaxy Mass Assembly with E-ELT/MOSAIC and lessons from the VLT & HST IMAGES Survey
14:30	Joss Bland-Hawthorn	The Hector survey: an integral field spectrograph survey of 100,000 galaxies
15:00	Christy Tremonti	Measuring Gas Accretion and Outflow Signatures with MaNGA
15:20	*Coffee & Poster Viewing*	
15:50	Poster Winners (3 talks of 10 min)	
16:20	Glenn van de Ven	Conference Summary & Discussion
17:20	*End*	

Monday, 7 July

09:15 Review

How Interferometry has Informed Our Knowledge of Galactic Structure: from Ryle's Aperture Synthesis to ALMA

Trimble, Virginia University of California

The first radio telescope (Jansky's) was an array. The second (Reber's) was a parabola of revolution, but he later built an assortment of arrays and interferometers. The early years of radio astronomy were somewhat darkened by disputes about flux measurements, calibrations, and counts of radio sources as performed by parabolas (favored by Manchester and some Australians) and aperture synthesis interferometers (favored by Cambridge and some other Australians, initially for solar radio astronomy). Other countries also voted: Germany did parabolas, the Netherlands arrays. In the US, decadal surveys dithered between what eventually became the large parabolas at Greenbank and the VLA (for which Reber had absolutely no use). If you look around today, you will see an assortment of arrays made of parabolas of revolution, whether you look at Owen's Valley, the Australia Telescope, the expanded VLA, or ALMA. The talk will look at the interplay between the kinds of radio telescopes and what they have told us about 3-dimensional galaxy structures (triaxial ellipsoids, warped disks and flares, bars and bulges, and all the other things we love about our own Galaxy and others.

09:45 Review

The Local Universe: Galaxies in 3D

Koribalski, Baerbel CSIRO Australia Telescope National Facility

I will present the results of individual galaxy studies and galaxy surveys in the Local Universe with particular emphasis on the spatially resolved properties of the neutral hydrogen gas. The 3D nature of the data allows detailed studies of the galaxy morphology and kinematics, how these are related to the local and global star formation as well as the galaxy environment. I will use new 3D visualisation tools to present multi-wavelength data, informed by tilted-ring models of the warped galaxy disks. Many of the algorithms and tools currently under development will be essential for the analysis of upcoming large data sets, but are also highly beneficial for current galaxy surveys.

10:15 Invited

KMOS at the VLT: Commissioning and Early Science

Sharples, Ray Durham University

KMOS is a multi-object near-infrared integral field spectrometer which was commissioned at the ESO VLT in spring 2013 and made available to the user community from Oct 2013. We present the unique capabilities of KMOS for 3D galaxy surveys and the implications for target preparation and data analysis. Examples will be given of the first science from the commissioning, science verification and guaranteed time observations.

10:35 Contributed

TYPHOON

Madore, Barry F. Carnegie Observatories

I shall describe TYPHOON, a long-term, on-going program being undertaken at Carnegie telescopes at Las Campanas Observatory in Chile. The primary aim is to construct large-scale, spectrophotometric data cubes for the largest angular-sized galaxies in the southern hemisphere. As currently deployed at the duPont 2.5 m and the Baade 6.5 m telescopes TYPHOON is producing data cubes whose spectral coverage is from 3600 to 9000 Å, with a spectral resolution of 5 Å. The largest data cubes assembled to date cover 15 by 20 arcmin with a spatial resolution of 1.4 arcsec. Numerous examples of data cubes already obtained and reduced will be shown.

11:20 Review

Characteristics and Scientific Impact of 2nd Generation 3D Spectrographs in the Visual (MUSE, VIRUS, etc.)

Roth, Martin M. Astrophysikalisches Institut Potsdam

The last decade has seen facility instruments for integral field spectroscopy in the visual and in the NIR at basically all major ground-based observatories to the extent that the technique has to be considered mature. Single-pointing 3D spectrographs such as SAURON or PMAS are being used for large survey programs, and more recent developments are even exploring opportunities for multiobject integral field spectroscopy. However, due to technological constraints, the number of spectra of the first generation instruments have remained limited to an order of magnitude of ~ 1000. However, on the basis of optimized modular architectures, we are now entering an era of instruments that offer two orders of magnitude higher multiplex capabilities in comparison to what was available previously. I will review the advance of technology with reference to the prominent examples of MUSE and VIRUS, and discuss the scientific impact of these 2nd generation instruments.

11:50 Contributed

Mapping Star Formation Histories of Early-Type Galaxies with the Atlas3D Survey

McDermid, Richard Macquarie University

The Atlas3D survey comprises integral-field spectroscopy for a complete, volume-limited sample of 260 early-type galaxies observed within the local 40 Mpc volume. This K-band selected sample spans a range in mass from 10^{10} to 10^{12} solar masses, and probes two orders of magnitude in local galaxy density, giving a large range in mass and environment. Our integral-field spectroscopy covers on average more than one effective radius, providing a complete picture of most of the stellar and ionized gas content of these objects. We will present new results from spectral fitting of these data to derive spatially-resolved star-formation histories for these objects, and compare these to the unique suite of multi-wavelength Atlas3D data, including neutral and molecular gas interferometric maps. We combine this information with the global properties of the sample, including accurate mass estimates, environment metrics and IMF, and try to construct a coherent picture of early-type galaxy formation.

12:05 Invited

The Recent Evolution of Early-Type Galaxies, as Seen in their Cold Gas

Young, Lisa New Mexico Tech

The cold (atomic and molecular) gas in early-type galaxies reveals the galaxies' recent histories through the processes of gas accretion, consumption, and removal. In this context, I will review new insights from our work on cold gas in the Atlas3D sample of early-type galaxies. Two crucial aspects of this work are that the sample is volume-limited, and that for the first time we have both atomic and molecular gas kinematics for synergies with full IFU-based stellar and ionized gas kinematics. For example, from the gas and stellar kinematics we learn that much of the cold gas in early-type galaxies must have an external origin. But there are systematic differences between the gas kinematics of field and Virgo Cluster early-type galaxies, and between high-mass and low-mass galaxies, and in these ways the gas properties emphasize the diversity in the recent histories of early-type galaxies. I will also discuss trends in gas properties with stellar populations and differences between the atomic and molecular properties of early-type galaxies. I will highlight some areas where the cold gas in early-type galaxies is beginning to provide direct constraints on numerical simulations of galaxy evolution and on a galaxy-wide view of the star formation process.

12:25 Contributed

Inner polar ionized-gas disks and properies of their host galaxies

Silchenko, Olga Sternberg Astronomical Institute of the MSU

I have analysed line-of-sight velocity fields of the stellar and ionized-gas components for the volume-limited sample of nearby lenticular galaxies by using the raw data of the ATLAS-3D survey undertaken with the integral-field spectrograph SAURON. Among 200 nearby lenticular galaxies, I have found 20 cases of orthogonal rotation of the inner ionized gas with respect to the central stellar component; so I estimate a frequency of inner polar disks in nearby S0 galaxies as 10%. Properties of the central stellar populations – mean ages, metallicities, magnesium-to-iron ratios – are derived through the Lick index calculation. In my talk, I will compare the typical stellar population properties of the polar-disk host galaxies with the stellar population properties of the complete sample of nearby S0 galaxies.

14:10 Review

Schmidt's Conjecture and Star Formation in Galactic Molecular Clouds and External Galaxies

Lada, Charles Smithsonian Astrophysical Observatory

The star formation rate and its variation in time are intimately connected to our understanding of the formation and evolution of the Milky Way and external galaxies. Ever since the pioneering work of Schmidt a half-century ago there has been great interest in finding an appropriate empirical relation that would directly link some property of interstellar gas with the process of star formation within it. Schmidt conjectured that this might take the form of a relation between the rate of star formation and the surface density of interstellar gas. In this talk I will describe how modern observations of nearby Galactic molecular clouds are now providing new insights into this relationship. I will show that though a Schmidt relation is observed within individual molecular clouds, there is no Schmidt law that characterizes star formation between the clouds in the Milky Way. Instead, a linear scaling exists between the total SFR and the amount of dense gas within molecular clouds. This scaling may be the underlying physical relationship that most directly connects star formation activity with gas both between clouds in the Milky Way and within and between external galaxies. Finally, I will discuss the implications of these results for the Kennicutt-Schmidt relation for galaxies.

14:40 Contributed

The Spatially-Resolved Star Formation History of the M 31 Disk from Resolved Stellar Populations

Lewis, Alexia University of Washington

The Panchromatic Hubble Andromeda Treasury (PHAT) is an HST multi-cycle treasury program that has mapped the resolved stellar populations of 1/4 of the disk of M 31 from the UV through the near-IR. This data provides color and luminosity information for more than 150 million stars. Using stellar evolution models, we fit the luminous main sequence to derive spatially-resolved recent star formation histories (SFHs) over large areas of M 31 with 100 pc resolution. These include individual star-forming regions as well as quiescent portions of the disk. With these gridded SFHs, we create movies of star formation activity to study the evolution of individual star-forming events across the disk. We analyze the structure of star formation and examine the relation between star formation and gas throughout the disk and particularly in the 10-kpc star-forming ring. We find that the ring has been continuously forming stars for at least 500 Myr. As the only large disk galaxy that is close enough to obtain the photometry for this type of spatially-resolved SFH mapping, M 31 plays an important role in our understanding of the evolution of an $L_\star$ galaxy.

14:55 Invited

Gas, Dust and Star Formation in the Whirlpool galaxy

Schinnerer, Eva MPIA

Understanding the processes that regulate the formation of stars within galaxies is one of the major themes in current astrophysical research. Detailed observations on the scales of Giant Molecular Clouds (~ 40 pc) can provide interesting insights on the properties of the star forming interstellar medium, i.e. cold neutral gas and dust, and conditions promoting the formation of massive stars. Combining exquisite data on the molecular gas disk in the grand-design spiral galaxy M 51 at 40 pc resolution from the PdBI Arcsecond Whirlpool Survey (PAWS) with ancillary data across the electromagnetic spectrum allowed us to investigate in detail how molecular gas, dust and star formation relate in star forming and non-star forming sites and test common assumptions about Giant Molecular Clouds. I will present the highlights from these studies.

15:15 Contributed

ALMA Explorations of Dense Warm Molecular Gas and Cold Dust in Nearby LIRGs

Xu, Kevin California Institute of Technology

I will present results of ALMA (Cycle-0) observations of the CO (6-5) line emission and the 435 micron continuum emission of two nearby luminous infrared galaxies NGC 34 (a major merger with an AGN) and NGC 1614 (a minor merger with a circum-nuclear starburst). Using receivers in the highest frequency ALMA band available (Band-9), these observations achieved the best angular resolutions ($\sim 0.25''$) for ALMA Cycle-0 observations and resolved for the first time distributions of dense warm molecular gas ($n > 10^5\,\mathrm{cm}^{-3}$, $T > 100\,\mathrm{K}$) in LIRGs with spatial resolutions better than 100 pc. Our ALMA data show a very tight correlation between the CO (6-5) line emission and cold dust continuum emission, suggesting the dense warm molecular gas dominating the ISM in LIRG nuclear regions. On the other hand, we saw very different spatial distributions and kinematic properties of dense warm gas in the two LIRGs, indicating that physical conditions in the ISM can be very different in different LIRGs. The relations between dense warm gas, star-formation, AGN, and the dependence of these relations on the merger history will be discussed.

15:30 Contributed

Ionized and neutral gas in the XUV discs of nearby spiral galaxies

Lopez-Sanchez, Angel Australian Astronomical Observatory

We are using the 2dF/AAOmega instrument at the 3.9 m Anglo-Australian Telescope to perform multi-object fibre spectroscopy of UV-rich regions within and surrounding gas-rich spiral galaxies of the Local Volume. The target galaxies show a very extended UV-disc (XUV) well beyond their B25 radius. In this talk I will present the results of the multiwavelength analysis of the NGC 1512/1510 and M 83 systems. We confirm the detection of ionized gas in the majority of the observed UV-rich region. We characterize its physical properties (extinction, electron temperature and density, ionization degree), chemical abundances and kinematics. This study allows us to find satellite dwarf galaxies and confirm or not tidal dwarf candidates. Combining these results with our deep HI data from the "Local Volume HI Survey" (LVHIS) project and the available UV (GALEX) and MIR (Spitzer) data, we are getting new clues about local star-formation processes, the interplay between the ISM and the IGM, the metal redistribution in the outer gaseous discs of spiral galaxies and its effect on the mass-metallicity relation, the importance of galaxy interactions, the fate of the neutral gas and the chemical evolution in nearby galaxies.

15:45 Contributed

The WSRT HALOGAS Survey

Heald, George ASTRON

I will describe the HALOGAS (Hydrogen Accretion in LOcal GAlaxieS) Survey, which is the deepest systematic investigation of cold gas accretion in nearby spiral galaxies to date. It consists of extensive Westerbork Synthesis Radio Telescope (WSRT) observations of 22 edge-on and moderately-inclined nearby galaxies, each observed for 120 hours in the HI line. Using these data we are able to detect neutral hydrogen down to a typical column density limit of about 10^{19} cm^{-2}, and characterize the low surface brightness extra-planar and anomalous-velocity neutral gas with excellent spatial and velocity resolution. Through comparison with sophisticated kinematic modeling, our 3D HALOGAS data also allow us to investigate the disk structure and dynamics in unprecedented detail for a sample of this size. This talk will summarize key scientific results coming from the HALOGAS project, including new insight into the connection between the star formation properties of galaxies and their extended gaseous media. The developing HALOGAS catalogue of cold gas clouds and streams will also be presented in the context of the accretion history of nearby spirals. Finally, I will motivate some of the unresolved questions to be addressed using forthcoming 3D surveys with the modern generation of radio telescopes.

16:30 Contributed

An IFS survey of local luminous star forming galaxies: Ionized gas outflows and global ISM kinematics

Arribas, Santiago CSIC

We study the ISM kinematics and ionized gas outflow properties of a large and representative sample of local U/LIRGs (59 systems, 75 individual galaxies), on the basis of IFS observations obtained with VIMOS/VLT and INTEGRAL/WHT. The sample covers a wide range in SFR and SF density, encompasses the different interaction and merger phases, and it includes a significant fraction of AGNs. Therefore, it allows us to discuss how the kinematics of the ISM and outflows relate to different physical processes, as well as to analyze the observed trends in the context of recently published detailed simulations. The kinematic properties of local U/LIRGs are also compared in detail with those inferred from IFS-based studies for high-z galaxies of similar SFRs. Finally we analyse the potential of the IFS capabilities of NIRSpec/JWST and HARMONI/E-ELT for this type of studies.

16:45 Contributed

Gas Flows in Early-Type Galaxies

Sarzi, Marc University of Hertfordshire

Early-type Galaxies used to be regarded as simple, passively evolving stellar systems mostly devoid of gas. Over the years it has become clear that early-type galaxies do contain gas, albeit in widely varying amount and in different phases. Thanks to the integral-field, radio, mm, and X-ray data for the complete ATLAS^{3D} survey of 260 early-type galaxies, it is now possible to draw a more comprehensive picture for the origin and fate of the gas in these galaxies, in particular in light of the revised classification of early-type galaxies as fast and slowly-rotating systems. In Vienna I will not only review the different directions in which both stellar-mass loss and external gas flows in and out of early-type galaxies, but also discuss in particular the impact of active nuclei on the ionised-gas kinematics of these objects and the relevance of these findings in the context of AGN feedback in galaxy formation.

17:00 Contributed

Dissecting the 3D structure of ellipticals with gravitational lensing and stellar kinematics

Barnabè, Matteo Dark Cosmology Center

Understanding the formation and evolution processes of early-type galaxies remains among the most important unsolved problems in present-day astrophysics and cosmology. A reliable and detailed description of the density profile, mass budget and structural properties of ellipticals through cosmic time is a much-needed step forward but – whereas nearby ellipticals have been thoroughly analyzed – painfully little is known about more distant systems, since observational limitations make it difficult to employ the traditional diagnostic tools. In my talk I will describe how to overcome these difficulties by combining the information obtained from all the available constraints: strong gravitational lensing, extended/2D stellar kinematics and stellar population synthesis modeling. This provides a robust way to conduct unprecedentedly detailed investigations of the dark and luminous structure of ellipticals at redshift $z = 0.1$ and beyond. I will illustrate the results of the application of this combined approach to a sample of SLACS/XLENS elliptical lenses for which exquisite high-res VLT X-Shooter spectroscopic observations are at hand. By complementing the results of the joint lensing and dynamics study with the inferences from a spectroscopic SPS analysis of optical line-strength indices, we can not only determine the mass density profile of these systems, but also put strong constraints on both the steepness and (for the first time) the lower cut-off of their stellar IMF.

17:15 Contributed

Revisiting the stellar counter rotation in NGC 3521, NGC 7217 and NGC 7331 with VIRUS-W

Fabricius, Maximilian Max Planck Institute for Extraterrestrial Physics

We have obtained high spectral resolution ($R \sim 9000$), integral field observations of the three spiral galaxies NGC 3521, NGC 7217 and NGC 7331 using the new fiber-based Integral Field Unit instrument VIRUS-W at the 2.7 m telescope of the McDonald Observatory in Texas. Our data allow us to revisit previous claims of counter rotation in these objects. A detailed kinematic decomposition of NGC 7217 shows that no counter rotating stellar component is present. We rather find a low dispersion ($\sigma \sim 20\,\mathrm{km/s}$), rotating ($V_{\mathrm{max}} = 150\,\mathrm{km/s}$) disk that is embedded in a high velocity dispersion stellar halo ($\sigma \sim 170\,\mathrm{km/s}$) or bulge that is co-rotating ($V_{\mathrm{max}} \sim 50\,\mathrm{km/s}$) with the disk. Due to the very different velocity dispersions, we are further able to perform a Lick index analysis on both components separately which indicates that the two stellar populations are clearly separated in Mgb/$\langle$Fe$\rangle$ space. The velocities and dispersions of the faster component are very similar to those of the interstellar gas as measured from the [OIII] emission. Morphological evidence of active star formation in this component further suggests that NGC 7217 may be in the process of (re)growing a disk inside a more massive and higher dispersion stellar halo.

17:30 – Highlight talks

1 Highlight

Optimizing Signal-to-Noise and Spatial Resolution in 3D Spectroscopy with the WIYN Observatory's New Unique Multi-fiber Size IFUs

Hooper, Eric WIYN Observatory & University of Wisconsin – Madison

Two new integral field units (IFUs) were recently installed on the WIYN Observatory's 3.5-meter telescope at Kitt Peak (Matthew Bershady, PI). They are currently being commissioned and are supporting early science observations. These unique IFUs contain fibers of different sizes in the same head. This design allows smaller fibers to sample regions of higher surface brightness, providing higher spatial resolution while maintaining adequate signal-to-noise (S/N). Conversely, larger fibers maintain S/N at the expense of spatial resolution in the lower surface brightness regions of galaxies. The first IFU, HexPak, has a central core of 18 one-arcsec diameter fibers, surrounded by a halo of 84 three-arcsec fibers (40 arcsec total extent on sky). HexPak is designed for spheroidal or face-on disk galaxies, including those with a central bright concentration such as an AGN or nuclear starburst. The second IFU, GradPak, is an approximately rectangular array ($\sim 35'' \times 55''$), consisting of 11 fiber rows ranging in size from 2 to 6 arcsec (90 fibers total). It is designed for observing edge-on galaxies, with smaller fibers near the mid-plane and larger fibers sampling fainter emission perpendicular to the disk. Each fiber head contains separate sky fibers of every size.

2 Highlight

Giant molecular cloud properties are influenced by galactic environment

Hughes, Annie MPIA

Observations of star formation and molecular gas in nearby galaxies provide a complementary perspective to detailed studies of individual Galactic star-forming regions. Surveys of molecular gas in external galaxies with cloud-scale resolution are especially valuable, since they characterize the initial conditions for star formation across differ-

ent galactic environments. In this talk, I will review our new findings about the molecular cloud populations in several nearby galaxies, focussing on our results from the PAWS CO survey of the nearby spiral galaxy M 51, and two new extensions of the MAGMA CO survey of the Large Magellanic Cloud (LMC), which target dense gas emission tracers (e.g. HCO^+, HCN) and cold dust structures identified in the Planck all-sky submillimetre surveys. The overall picture that emerges from these studies is that (i) Larson's scaling relations are not universal and (ii) both the physical properties and the star-forming activity of molecular clouds depend on galactic environment. In M 51, galactic-scale dynamical effects appear to play a key role in regulating the formation, destruction and stability of molecular clouds. To conclude, I will present an update on our cycle 1 ALMA observations of the molecular cloud population in the nearby spiral galaxy NGC 628.

3 Highlight

A kinematic analysis of the giant star forming regions of N11

Torres-Flores, Sergio Universidad de La Serena

We present new high-resolution FLAMES-VLT optical spectroscopy of the giant star-forming region N11 in the Large Magellanic Cloud. To study the kinematics of this region, we observed both a regular and an irregular grid of positions over N11 to map the Hα emission line. We found that N11 displays a complex kinematics in their central region, which is associated with an expanding bubble. Regions N11A and N11C are characterized by having simple Hα profiles. N11B displays asymmetric Hα profiles, which are associated with small expanding structures, as suggested by previous authors. We fitted single Gaussians to each observed profile and we found that several regions in N11 can be fitted by Gaussians having subsonic motions. We have fitted a single Gaussian component to the integrated Hα profile of N11 and found a supersonic width of $\sigma = 11.87\,\mathrm{km/s}$. A single Gaussian fit on the observed integrated profile leaves the wings incorrectly fitted, hence suggesting the addition of a secondary broad and low-intensity Gaussian component. In order to test the validity of this secondary component, we have used the single Gaussians fit on each observed profile to derive a synthetic data cube of N11. By adding all the profiles, we

generated a synthetic integrated Hα profile for which a secondary component is also necessary to explain the wings. This fact suggests that the low-intensity broad component does not exist in all of N11 but instead it emerges from the addition of several expanding structures at different radial velocities. Our data also reveal a spatial correlation between high velocity features and soft diffuse X-ray emission. Our analysis for N11 will be compared with a similar analysis developed for 30 Doradus.

4 Highlight

3D chemo-dynamical simulations of Tidal Dwarf Galaxies

Ploeckinger, Sylvia Universität Wien

Tidal dwarf galaxies (TDG) form out of pre-enriched tidal debris of interacting galaxies. Although similar in size and mass to dwarf galaxies that form within the cosmological structure formation process, TDG cannot contain a significant amount of dark matter. I present high-resolution simulations of their early chemo-dynamical evolution in order to investigate under which circumstances TDG can survive active star formation (SF) and the disrupting tidal field. If the formation of TDG is observed and their long-term survivability is supported by observations and simulations: how can fossil TDG be identified and distinguished from dark matter dominated dwarf galaxies?

5 Highlight

The nature of isolated elliptical galaxies

Richtler, Tom Universidad de Concepcion

The growth of galaxies by hierarchical merging of both visible and dark matter is the leading paradigm of galaxy formation. Isolated ellipticals, residing in low-density environments, should therefore exhibit different halo properties to their counterparts in galaxy groups and clusters. We present a sample of isolated ellipticals with interesting properties, in-

cluding some which may create doubts on the canonical interpretation of dark matter.

6 Highlight

Dwarf ellipticals in the eye of SAURON: dynamical and stellar population analysis in 3D

Rys, Agnieszka Instituto de Astrofisica de Canarias

We present the dynamical and stellar population analysis of 12 dwarf elliptical galaxies (dEs) observed using the SAURON IFU (WHT, La Palma). We demonstrate that dEs have lower angular momenta than their presumed late-type progenitors and we show that dE circular velocity curves are steeper than the rotation curves of galaxies with equal and up to an order of magnitude higher luminosity. Additionally, we see that galaxies in the cluster outskirts tend to have a higher dark-to-stellar matter ratio. Transformation due to tidal harassment is able to explain all of the above, unless the dE progenitors were already compact and had lower angular momenta at higher redshifts. We then look at the star formation histories (SFHs) of our galaxies and find that for the majority of them star formation activity was either still strong at a few Gyr of age or they experienced a secondary burst of star formation roughly at that time. This latter possibility would be in agreement with the scenario where tidal harassment drives the remaining gas inwards and induces a secondary star formation episode. Finally, one of our galaxies appears to be composed exclusively of an old population ($\gtrsim 12\,\mathrm{Gyr}$). Combining this with our earlier dynamical results, we conclude that it either was ram-pressure stripped early on in its evolution in a group environment and subsequently tidally heated (which lowered its angular momentum and increased compactness), or that it evolved in situ in the cluster's central parts, compact enough to avoid tidal disruption.

7 Highlight

Extragalactic Archeology: dissecting galactic bulges in space and time

Seidel, Marja Instituto de Astrofisica de Canarias

Studies of galactic bulges in the local universe have provided powerful constraints on their formation and evolution. In this talk, we present three significantly different bulges mapped with the integral field spectrograph WiFeS on the ANU 2.3 m telescope in Siding Spring Observatory, Australia. We perform an exhaustive stellar population analysis using the WiFeS spectra with its high resolution ($R = 7000$) gratings, combining the classical approach via line-strength indices with full spectral fitting techniques. Furthermore, we use an innovative technique to recover simultaneously the 2D dynamics and associated ages and metallicities of the present stellar populations to constrain scenarios for the secular or merger-driven evolution of these galactic bulges. In all cases we find a combination of various populations presenting intriguing insights on their individual properties: the old stellar population shows lower rotation velocities, higher velocity dispersions and shallower metallicity gradients; but its fraction varies largely in the three cases. This, in combination with the abundance measurements, showing subsolar up to – in one case supersolar abundances throughout – leads to different and complex formation scenarios of the distinct bulge types. The separation of stellar populations – by ages, metallicities and associated dynamical properties – is critical to better understand the physics of the past and ongoing evolution in galaxies.

8 Highlight

Metallicity Gradients in the Outer Halos of Massive Early-type Galaxies from 3D Spectroscopy

Foster, Caroline Australian Astronomical Observatory

The metallicity gradients in the outer regions of massive early-type galaxies, where formation signatures are long-lasting, provide important clues to galaxy assembly. However they are traditionally hard to probe. I present results from the SLUGGS survey which extends ATLAS3D-like maps of stellar metallicities from $\sim 1R_e$ to $\sim 3R_e$ using 3D spectroscopy. Using globular clusters as a stellar proxy this is extended further to

$\sim 10R_e$. From this, and additional multiwavelength data, we find evidence for a transition in halo properties at several effective radii, including the radius that may mark the transition between a dissipative in-situ core and an outer accretion-dominated halo. We find a trend for outer gradients to steepen for lower mass galaxies. Comparison with the latest simulations strongly indicates that feedback is required to match this trend. Our data support a picture in which early-type galaxy halos grow from the accretion and disruption of low mass galaxies (and their globular cluster systems). Constraints on the mass function of accreted galaxies can also be derived.

Tuesday, 8 July

09:00 Review

IFU Surveys, a panoramic view on galaxy evolution

Sanchez, Sebastian F. IA-UNAM

Most of our current understanding on galaxy evolution has been provided to the large amount of data provided by large spectroscopic(SDSS, 2dF, zCOSMOS) and imaging (SDSS, GOODs, GEMS) surveys. Based on well defined statistical samples, covering a wide range of galaxies parameters, and providing large number of observations, they are unique databases to study many different parameters in galaxies: Star-formation, star-formation history, chemical enrichment, mass growth, AGN activity...However, despite of their advantage, those surveys still provide a limited view on the galaxy properties. On the last few decades a new family of surveys, based on Integral Field Spectroscopy, has introduced a new dimension to our understanding of galaxies, providing with a real panoramic view of their spectroscopic properties and allowing us to understand the different interconnected processes (SFR, SFH, chemical enrichment, gas and star dynamics) from a spatial resolved perpective. Here I will try to review the different existing (SAURON, Atlas3D), on-going (CALIFA) and recently started (MaNGA, SAMI) large IFU surveys, and summarize their main characteristics and recent results. I will make emphasis on those results that may change our view on galaxy evolution, and would be impossible to investigate using other more traditional techniques.

09:30 Invited

Resolving galaxies in time and space: Methods, uncertainties & results

Cid Fernandes, Roberto Universidade Federal de Santa Catarina

This contribution will present the Python CALIFA STARLIGHT Synthesis Organizer (PyCASSO) pipeline. This new tool extends the kind of spectral synthesis work previously done for integrated galaxy spectra to IFU datacubes, producing spatially resolved maps of stellar population properties as recovered by the STARLIGHT code. PyCASSO offers several ways of exploring this manifold, including 2D maps of the velocity field, stellar extinction, mean ages, metallicities, mass surface densities, star formation rates on different time scales and normalized in different ways, 1D averages in the temporal and spatial coordinates, and projections of the stellar light and mass growth onto radius-age diagrams which allow the visualization of galaxy evolution in time and space simultaneously. Uncertainties due to the data and to ingredients used in the spectral synthesis were evaluated and found to be of the same order. Results already obtained by applying this tool to CALIFA datacubes include (a) evidence for inside-out growth in massive galaxies, (b) the relation between half mass and half light radii, (c) the role of mass and mass surface density in the growth of bulges and disks, and (d) that effective radii are really effective, in the sense that properties at 1 $R_{\rm eff}$ match closely those derived from spatially integrated properties.

09:50 Invited

The Star Formation History of Galaxies in 3D: CALIFA Perspective

Gonzalez Delgado, Rosa Instituto de Astrofísica de Andalucía

We present the spatially resolved star formation history (SFH) of galaxies for a sample of 300 galaxies from the CALIFA survey. We applied the fossil record method based on spectral synthesis techniques to recover SFH, resolved in space and time, in spheroidal and disk dominated galaxies with masses from 10^9 to 10^{12} $M_\odot$. We derived the radial structure of the properties of the stellar populations such as age, metallicity, stellar extinction, and stellar mass surface density. We discuss the results as a function of the galaxy stellar mass, morphology, total angular momentum, and the strength of a bar. We also compare the SFH of a few mergers that are included in the CALIFA sample with that of isolated galaxies.

10:10 Contributed

Extended nebular emission in CALIFA early-type galaxies

Papaderos, Polychronis Centro de Astrofísica da Universidade do Porto

An ongoing investigation of 32 early-type galaxies (ETGs) from the Calar Alto Legacy Integral Field spectroscopy Area survey (CALIFA) reveals the presence of faint nebular emission several kpc away from the ETG nuclei. The nature of the dominant excitation mechanism of this extended ionized gas component will be discussed in the light of the observed radial distribution of diagnostic line ratios and H-alpha equivalent width. Among other things, we find that in more than half of the sample galaxies, 70-90% of the Lyman continuum (LyC) photon output from post-AGB stars (consequently, from any other discrete or diffuse ionizing source) escapes into the intergalactic space without being reprocessed into nebular emission. We argue that, because of extensive LyC photon leakage, nuclear emission-line luminosities and equivalent widths in these systems are reduced by at least one order of magnitude. Consequently, the line weakness of these ETGs, all of which show LINER-specific spectroscopic properties, is by itself no compelling evidence for their containing merely "weak" (sub-Eddington accreting) active galactic nuclei.

10:25 Invited

The MASSIVE Survey: an IFU Study of the Most Massive Galaxies within 100 Mpc

Ma, Chung-Pei University of California at Berkeley

I will describe an ongoing IFU survey to target the most massive early-type galaxies within 100 Mpc. This survey will fill in a previously little explored parameter space and provide new measurements of stellar M/L and IMF, dark matter distributions, stellar population and kinematic gradients within galaxies, and black hole masses and scaling relations.

11:15 Review

The Structure and Scaling Relations of Spiral Galaxies

Courteau, Stephane Queen's University

Galaxies can be described in terms of their structure, dynamics and stellar populations. Some very robust correlations between various galaxy structural properties, such as total luminosity, maximum circular velocity, and size show rather small scatter, hinting at well-regulated galaxy formation processes. A major challenge to understanding these scaling relations, and ultimately galaxy formation and evolution, is the elusive interplay between visible and dark matter. I will discuss the latest derivations of galaxy scaling relations and their link with the latest cosmological models. I will also address the value of idealised structural decompositions in this context.

11:45 Contributed

The first 1000 galaxies of the SAMI Galaxy Survey

Allen, James University of Sydney

Following a major upgrade to the Sydney-AAO Multi-object Integral field spectrograph (SAMI) in early 2013, the SAMI Galaxy Survey has entered its main survey phase. The survey is already the largest of its type, and by July 2014 will have obtained spatially-resolved spectra of over 1000 galaxies. The sample will continue to grow over the following two years. This unique dataset allows a wide range of investigations into different aspects of galaxy evolution. Highlights include studies of stellar kinematics and the build-up of mass in galaxies, investigations of the fundamental plane and Tully-Fisher relation, and measuring the spatial distribution of star formation as a function of environment. A comprehensive program of simulations is also under way, to provide insight into the physical interpretation of the observed results. I will give an overview of the survey design and current status, and present the first public release of SAMI data. This data release, scheduled to occur around the time of the Galaxies in 3D Symposium, will consist of the complete data for 100 galaxies drawn from the full survey. By giving early access to SAMI data for the entire research community, we aim to stimulate research across a broad range of topics in galaxy evolution. I will also discuss some of the ongoing scientific investigations within the SAMI team, the future direction of the survey, and the results we expect to obtain from the complete sample of 3000 galaxies.

12:00 Contributed

The SAMI Galaxy Survey: Probing the Evolution of Early-Type Galaxies through Stellar Kinematics

Fogarty, Lisa University of Sydney

Pioneering work by SAURON and ATLAS-3D has recast the morphological dichotomy of early-type galaxies (ETGs) in terms of kinematic morphology. Thus, we move to a system where ETGs are classified as fast or slow rotators (FRs or SRs) using a proxy for stellar angular momentum. It is intriguing to ask how these galaxies are formed – are they truly different from one another? What is the difference in their merger histories? Does environment play a role in their formation and evolution? The SAMI Galaxy Survey is perfectly positioned to answer these questions. With our large-scale integral field galaxy survey of $\sim$ 3500 objects over a wide range of environments, we can measure stellar kinematics, and thus kinematic classifications, for an unprecedented number of ETGs. By the time of this conference we will have observed one third of our sample – the first integral field sample of over 1000 galaxies! I will present results from the SAMI Pilot Survey of 100 galaxies in three different clusters. We find FRs and SRs in each cluster, as expected. Excitingly, we also find SRs on the outskirts of the clusters, some of which are associated with in-falling groups. This strongly supports the hypothesis that SRs are not only formed in clusters, but across all environments with equal efficiency. The natural place to test this further is in the study of galaxy groups. The SAMI Galaxy Survey contains dozens of groups identified by the GAMA groups catalogue. I have analysed the stellar kinematics of all group members observed so far and I will present preliminary results from this new study.

12:15 Contributed

The stellar accretion origin of abundance gradients in massive galaxies at large radii

Hirschmann, Michaela Astronimical Observatory of Trieste – INAF

We present a detailed analysis of the evolution of the stellar metallicity and the corresponding abundance gradients at large radii ($3R_{\rm eff} < R < 10R_{\rm eff}$) of individual, massive galaxies. We have performed two sets of cosmological hydrodynamical zoom simulations of 10 haloes ($10^{12} < M_{\rm halo} < 10^{13}\,M_{\odot}$) considering metal cooling and an empirical model for galactic winds. Models including both galactic winds and metal cooling suppress early star formation at $z > 1$ and predict reasonable star formation histories for galaxies in present day halos of $< 10^{12}\,M_{\odot}$ (Hirschmann et al., 2013). Due to the delayed onset of star formation in the wind models, the metal enrichment of gas and stars is also delayed and agrees well with observational constraints. Most importantly, we show that only models including strong galactic winds result in massive galaxies with significantly steeper stellar metallicity gradients than models without galactic winds in overall agreement with recent observational studies. Such steep abundance gradients originate from the hierarchical accretion of lower metallicity stars from low mass satellites (as the metal enrichment is delayed particularly at high redshifts and low-mass galaxies). These results provide a possible explanation for the origin and evolution of abundance gradients of massive galaxies in hierarchical cosmological models.

14:00 Review

The Scaling of Star Formation: from Molecular Clouds to Galaxies

Calzetti, Daniela Department of Astronomy, University of Massachusetts

I will review extant literature and recent work on the scaling relation(s) that link the gas content of galaxies to the measured star formation rates. A diverse array of observing techniques and underlying physical assumptions characterize the determination of these relations at different scales, that range from the tens of parsec sizes of molecular clouds to the tens of kpc sizes of whole galaxies. I will review the different techniques and measurements, and also the strategies used by many authors to compare them. Although the picture is far from final, much progress has been accomplished over the past decade.

14:30 Contributed

Evolution of gas and dust over the past 5 billion years

Dunne, Loretta University of Canterbury

The cosmic averaged rate of star formation in galaxies has been rapidly declining since $z \sim 1$ to today. This implies changes in the way gas is supplied or conserved/expelled/consumed by galaxies in the most recent 8 Gyr of cosmic history. Probing the gas content of galaxies directly at these distances is very challenging but the wide area surveys of dust through far-infrared missions offer an interesting alternative. The Herschel-ATLAS is the widest area extragalactic survey conducted by the Herschel Space Observatory, covering 600 deg^2 in five far-IR bands. We have used the first release of this data to produce the dust mass function in galaxies over the range $0 < z < 0.5$, and show that it is strongly evolving, such that galaxies were on average 5 times dustier 5 Gyr ago compared to today. I will discuss what this means for the origin and evolution of cosmic dust and the implications for the evolution of the molecular gas content of galaxies.

14:45 Contributed

Dust attenuation, star formation rate density at $0 < z < 4$ and 3D spectroscopy onboard the WISH wide-field 1–5 μm telescope

Burgarella, Denis Laboratoire d'Astrophysique de Marseille

This presentation will report on a work that uses new homogeneous luminosity functions in the far-ultraviolet (FUV) from VLT and in the far-infrared (FIR), to study the evolution of the dust attenuation with redshift. With this information, we are able to estimate the redshift evolution of the total (FUV + FIR) star formation rate density (SFRDTOT). By integrating SFRDTOT, we follow the mass building and analyze the redshift evolution of the stellar mass density (SMD). This talk will provide a complete view of star formation from the local Universe to $z \sim 4$ and, using assumptions on earlier star formation history, compare this evolution with previously published data in an attempt to draw a homogeneous picture of the global evolution of star formation in galaxies (see Burgarella et al., 2013). We will present a new wide-field 1–5 μm space project (WISH, PI: T. Yamada) and, more specifically, an instrument dedicated to the spectroscopic study of the very high redshift universe and to the detection of the first galaxies. Onboard WISH, this 1–5 μm IFU spectrograph (PI: D. Burgarella) with a spectral resolution $R \sim 1000$ would be installed using either lenslets + fibers or slicers. The preliminary expected performances and the science associated to WISHSpec will be presented.

15:00 Contributed

Extremely High Gas Fractions in Clumpy, Turbulent Disks at $z = 0.1$

Fisher, David Swinburne University

In this talk I will discuss very high gas fractions that we observe in the clumpy disk galaxies at $z = 0.1$ in the DYNAMO survey. DYNAMO is an IFU survey of Halpha in ~ 100 galaxies at $z \sim 0.1$. DYNAMO galaxies are selected to have the highest Hα luminosity at their redshift, yet are not AGNs. Follow up results from HST, and kinematic maps from Keck and Gemini show that many DYNAMO galaxies are clumpy, rotating disks, with large internal velocity dispersion, similar to galaxies at $z = 1 - 2$. In this talk I will show that gas fractions in DYNAMO galaxies are 20-40%, much higher than typical local Universe galaxies (1–8%). The gas fraction of DYNAMO galaxies is similar to that of $z = 1 - 2$ disks (e.g. PHIBSS survey). DYNAMO galaxies vigorously are forming stars. The balance of depletion time ($M_{\rm gas}$/SFR) to specific star formation rate (SFR/$M_{\rm star}$) in DYNAMO galaxies is more similar to that of clumpy star bursting galaxies of the $z \sim 2$ epoch. The DYNAMO galaxies offer a sample of galaxies with gas rich, clumpy, turbulent disks, and due to their close distance we can measure the properties of individual clumps (such as size and density) with much higher precision than in $z = 2$ galaxies.

15:15 Contributed

Connecting Galaxy Dynamics with Star Formation using WIYN SparsePAK and WiFeS

Mogotsi, Moses Astronomy Department, University of Cape Town

SINGG-SUNGG (Meurer et al., 2006; Wong, 2007) is a H-alpha, R-band and UV survey of HI-selected star forming galaxies from HIPASS. We are performing spectroscopic observations of a subsample of galaxies from this survey in order to study the link between galaxy dynamics and star formation over a wide range of HI masses, metallicities, and star formation rates. These observations are being done with the multi-fiber WIYN SparsePAK spectrograph and the integral field WiFeS spectrograph. We are testing the constant-Q star formation law (Zheng et al., in prep.). This predicts that we can use the stellar surface density, velocity dispersion and rotation curve to determine the distribution of star formation and gas in a galaxy. Our observations are also being used as precursor observations for the MHONGOOSE survey planned on the MeerKAT radio telescope. We will present the spectroscopic observations of our sample and results from our star-formation - galaxy work.

15:30 Contributed

Disentangling kinematics and stellar populations in counter-rotating galaxies

Coccato, Lodovico ESO

The presence in galaxies of kinematically distinct stellar components (counter rotations, polar rings, KDC, etc.) is observed in several cases, and the census is now increasing thanks to the advent of integral field units. The knowledge of the stellar population parameters of *both* the decoupled components is the key to constrain their formation mechanisms. It is therefore necessary to separate the contributions of the decoupled components to the observed total spectrum at each position of the field of view. I will present a novel technique that exploits Integral Field Observations and enables to separate "at the same time" the kinematics and stellar population of the decoupled components. The technique has been successfully applied to the case of counter-rotating galaxies (Coccato et al., 2011, 2013). I will discuss also i) on-going developments of this technique to the case of bulge/disk decomposition, and polar disk galaxies, ii) applications to large IFU spectroscopic surveys like MANGA, and iii) future projects exclusively designed for the unique capabilities of MUSE, tailored to investigate the formation of counter-rotating and polar disk galaxies, and to separate IMF of the decoupled components. This aspect is extremely timely, given the forthcoming MUSE Science Verification.

16:15 – Highlight talks

1 Highlight

Kinematics of superdense galaxies in clusters

Moretti, Alessia Padova University, Physics & Astronomy department

I will present new results on the kinematics of superdense (i.e. small and massive) galaxies located in clusters of galaxies present in the WINGS survey of local clusters. In particular I will present the analysis of IFU spectra of 9 galaxies observed with GEMINI, and 8 with VIMOS. The analysis has been performed in collaboration with M. Cappellari using the JAM modeling, i.e. the dynamically modeling of the Jeans anisotropic multi-gaussian expansion of the data. We find that most of our galaxies possess a velocity dispersion that exceeds the one shown by larger galaxies in the nearby universe. We will discuss how this result can be interpreted in the current scenario for galaxy evolution, and in particular if it has influences on the predicted size evolution of early-type galaxies.

2 Highlight

A 3D view of the Hydra I cluster core - I. Kinematic substructures

Hilker, Michael European Southern Observatory

The mass determination of central cluster galaxies based on kinematical data normally uses simplified assumptions of virial equilibrium and spherical symmetry. The round appearance of these galaxies and the smooth distribution of hot X-ray emitting gas might suggest that these assumptions are justified. On the other hand, it has been shown that the halos of massive ellipticals grow by a factor of about 4 in mass since $z = 2$. The mass growth is dominated by the accretion of low mass systems (minor mergers). Thus, one might expect that accretion events leave kinematical signatures in the phase space of the outer stellar population especially of central cluster galaxies. These extreme environments, therefore, are suitable to study the main physical processes that cause the destruction of infalling galaxies as well as the build-up of the intra cluster light and the central dark matter halo of a galaxy cluster.

We will present the vivid case of the central giant elliptical of the Hydra I cluster, NGC 3311. This early-type galaxy dominated cluster is regarded as dynamically evolved. Recent photometric and kinematical studies of the diffuse stellar light, planetary nebulae and globular clusters in the core of Hydra I, however, have shown that 1) NGC 3311 exhibits a steeply rising velocity dispersion profile, 2) the velocity dispersion profiles differ from each other in different azimuthal directions (as judged from longslit analyses), and 3) the diffuse light is not evenly distributed around NGC 3311. An offset concentration of stars and a couple of tidal streams seem to be directly related to the dwarf galaxies in the cluster core. In order to find kinematic signatures of these substructures and to disentangle the turbulent past and present assembly history of the Hydra I cluster core, we used FORS2 in MXU mode to mimic a coarse 'IFU'. Our novel approach is to place short slits in an onion shell-like pattern around NGC 3311 to measure its 3D large-scale kinematics out to 3 effective radii. These data show that the velocity dispersion field varies as function of radius and azimuthal angle and violates point symmetry. Also, the line-of-sight velocity field shows similar dependence, hence the stellar system in NGC 3311 is out of equilibrium and evolving. Our results show that this complete spatial coverage is needed to avoid biases of radial kinematic profiles from longslit data and to draw conclusions about the dynamical state of NGC 3311 and the mass of its dark matter halo.

3 Highlight

A 3D view of the Hydra I cluster core - II. Stellar populations

Barbosa, Carlos Eduardo — Universidade de São Paulo

Several observations of the central region of the Hydra I galaxy cluster point to a multi-epoch assembly history of the intracluster light (ICL) and the dynamically hot stellar halo around the central cluster galaxy NGC 3311. Due to the long dynamical time scale of the system, the history of the assembly of the ICL is still imprinted in the properties of the stellar population distribution. Using our novel FORS2/VLT spectroscopic dataset of the Hydra I cluster core, i.e. short slits placed in an onion shell-like pattern around NGC 3311 to mimic a coarse 'IFU', we were able to map several absorption features in the optical wavelength

out to an unprecedented spatial coverage of 3 effective radii. We modeled the age, [Fe/H] and [α/Fe] distributions for the stellar populations in NGC 3311. Our results point to the presence of radial gradients of these three properties in the sense that the inner region is older, more metal-rich and more alpha-enhanced than the surrounding halo stars. Moreover, regions with photometric and kinematic substructures are analysed in order to see whether they are distinct or share the properties of stars in the smooth ICL around NGC 3311. Overall, our preliminary results are in agreement with the "two stages" formation scenario of central cluster galaxies, in which the central part of the galaxy is first formed "in situ", possibly in a quasi monolithic collapse with a rapid star formation burst, and then later grows its outer halo by accreting less massive systems with more extended star formation histories.

4 Highlight

The Transformation of Spiral Galaxies into Lenticulars

Johnston, Evelyn University of Nottingham

Lenticular (S0) galaxies are often thought of as evolved spirals, but the processes responsible for truncating the star formation in the spiral arms are still unclear. Was the star formation quenched by gas stripping? Or are S0s the result of minor mergers in which the disc structure was conserved? These two scenarios would affect the bulge and disc in different ways, and thus we can learn about the transformation by studying their independent star formation histories. To this end, we have developed a new technique of spectroscopic bulge-disc decomposition, in which the spatial light profile in a long-slit spectrum, or the image at each wavelength in an IFU spectrum, is decomposed wavelength-by-wavelength into bulge and disc components, allowing separate one-dimensional spectra for each component to be constructed. We have successfully applied this method to a sample of long-slit spectra of S0s from the Virgo Cluster to obtain clean, high-quality bulge and disc spectra for each galaxy, from which we have been able to build up a clear picture of their transformation. In this talk, I will present the results of this analysis, and the preliminary results from developing the IFU aspect of this technique with test observations from the MaNGA survey.

5 Highlight

Molecular gas and inefficient SF in intra-cluster regions of a ram pressure stripped wake

Jachym, Pavel Astronomical Institute, AS CR, Prague

We present discovery of large amounts of cold molecular gas in intra-cluster star-forming regions of the spectacular ram pressure gas-stripped tail of the Norma cluster galaxy ESO137−001. The amounts of molecular gas decrease along the tail, while masses of other gas phases (hot X-ray and warm ionized) are roughly constant. From Hα luminosities of HII regions occurring in the tail we found very low star formation efficiency indicating that most of the stripped gas does not form stars but remains gaseous and ultimately joins the intra-cluster medium. Turbulence driven into the ISM by ram pressure shocks is discussed as a possible source of heating. We have also searched for cold molecular gas, as well as for hot X-ray gas, in another star-forming gas-stripped tail in the Virgo dwarf galaxy IC 3418. Possibly because of a different evolutionary state and due to a lower thermal pressure of the surrounding intra-cluster gas, only sensitive upper limits were reached. Both ESO137−001 and IC 3418 are excellent candidates for galaxy transformation from blue to gas-poor types due to violent removal of their ISM by ram pressure stripping.

6 Highlight

The Effects of Harassment on Early Type Dwarfs – Sensitivity to Orbital Parameters

Smith, Rory Universidad de Concepcion

A galaxy in a cluster suffers tidal forces from the cluster potential well and high speed tidal encounters from other cluster galaxies – an effect known as 'harassment'. We study the effects of harassment on early type dwarf galaxies (dEs), with rich Globular Cluster (GC) systems, using a model of a cluster formed in a high-resolution cosmological simulation. We find that the baryons of dEs are well shielded by their dark matter halos, only suffering significant losses when their halos are heavily stripped. We test the sensitivity of harassment to a dwarf's orbital parameters, and find harassment is only effective for orbits whose peri-

centre falls deep within the cluster core. As a result, the vast majority of dEs (>85%) will show no indication of harassment, despite many Gigayears within the cluster. However those that appear harassed are currently found throughout the cluster, due to a broad range of orbital ellipticity. We also study if the GC system dynamics of dEs provide reliable dynamical masses, despite the effects of harassment. We find that dynamical masses can be measured surprisingly well (to within 30%) thanks to the short relaxation times of the GC system, and the quick removal of unbound GCs.

7 Highlight

Using 3D Spectroscopy to Understand the Relationship Between Classical Bulges, Pseudobulges, and Supermassive Black Holes

Erwin, Peter MPE

I will present results from VLT-SINFONI 3D spectroscopic observations of the centers of nearby S0 and spiral galaxies where both classical bulges and disky pseudobulges are found, sometimes together in the same galaxy. The SINFONI observations, made in adaptive-optics mode, allow us to measure the stellar kinematics in the galaxy centers with exquisite resolution; we use the stellar kinematics to measure central supermassive black hole masses and also to disentangle the stellar orbital structure of the different central components. This includes distinguishing the relative contributions of kinematically hot (classical bulge) and kinematically cool (pseudobulge) components in the same galaxy.

8 Highlight

Super-Massive Black Holes in Compact Galaxies

van den Bosch, Remco MPIA

Correlations linking the mass of the black hole in the centers of galaxies to bulge properties have been clearly established over the past decade. However, there still remain major open questions, particularly concern-

ing the sparsely populated upper end of the black hole mass distribution. Recently, I discovered several ultra dense galaxies in the local universe with extremely high velocity dispersions ($> 350\,\mathrm{km/s}$). These galaxies are compact, rotating, and have small luminosities for their large dispersions, in sharp contrast to the objects typically found at the upper end of the black hole mass – bulge relations. Using deep PPAK, OSIRIS, NIFS IFU and HST observations we have carried out dynamical black hole mass measurements, but also constrained the IMF, dark matter and orbital structure. Leading to a better understanding of the poorly characterized high end of the scaling relationships. These galaxies are kinematically and morphologically quite distinct from the vast majority of present-day early-types. But their compactness, morphology and kinematics are very similar to the compact passive galaxies at higher redshift ($z > 2$). By combining both the deep large scale PPAK and small scale adaptive optics data we can study these systems from the black hole to many effective radii.

9 Highlight

Quasar ionization echoes and 100,000 year baseline AGN light curves

Schirmer, Mischa Gemini Observatory

Green Bean galaxies feature ultra-luminous emission line regions around radio-quiet type-2 AGN. Extending over up to 100 kpc, they retain a memory of an AGN's activity over the last 100,000 years, and we work towards reconstructing the according light curves. This also opens a new window into SMBH accretion, galaxy evolution and AGN feedback. In this presentation I will present exciting first results from our demanding observational campaign, consisting of deep IFU and Chandra observations.

10 Highlight

The mass-metallicity and fundamental metallicity relations at $z \sim 1.4$ using VLT-SINFONI near-infrared spectroscopy of zCOSMOS galaxies

Maier, Christian Universität Wien

In the local universe, there is good evidence that, at a given stellar mass M, the gas-phase metallicity Z is anti-correlated with the SFR of the galaxies. It has also been claimed that the resulting $Z(M, \mathrm{SFR})$ relation is invariant with redshift – the so-called "Fundamental Metallicity Relation" (FMR). To explore this issue at $z > 1$, we have just obtained a few months ago VLT-SINFONI near-infrared spectroscopy of 8 zCOSMOS galaxies at $1.3 < z < 1.4$ to measure the strengths of Hβ, [OIII], Hα, and [NII], additional to [OII] measured with VIMOS. This near-infrared spectroscopy enables us to derive quite reliable O/H metallicities, and also SFRs from extinction corrected Hα measurements. We find that the mass-metallicity relation (MZR) of these star-forming galaxies at $z \sim 1.4$ is lower than the local SDSS MZR by a factor of three to five, a larger change than found by other authors using [NII]/Hα-based metallicities from individual and stacked spectra. I discuss how the different selections of the samples and metallicity calibrations used may be responsible for this discrepancy. I will also discuss the comparison of these SINFONI observations with the predictions of the $Z(M, \mathrm{SFR})$ of the physically motivated gas-regulation model of Lilly et al. (2013), which predicts the MZR and FMR evolution in the context of dark matter haloes of galaxies.

11 Highlight

Investigating the evolution of merger remnants from the formation of gas disks

Ueda, Junko National Astronomical Observatory of Japan

Major merger of two disk galaxies are widely believed to provide a way to form a spheroid-dominated early-type galaxy. Contrary to this classical scenario, recent simulations with more realistic gas physics have shown that some mergers will reform extended gas disks and evolve into disk-dominated late-type galaxies. In order to check this

scenario and look for observational evidence of a forming molecular gas disk, we investigate interferometric CO maps of 37 optically-selected merger remnants. New maps were obtained toward 27/37 sources with ALMA, CARMA, and SMA. We find that 65% (24/37) of the sample show kinematical signatures of the molecular gas disk in their velocity fields. However, the majority of the merger remnants except for a few shows a compact molecular gas disk relative to the stellar spheroidal component. Unless the disks grow significantly, for example from the return of ejected molecular gas or tidal HI gas, the majority will likely evolve into early-type galaxies. We tentatively suggest that a few sources with an extended gas disk and a large gas mass fraction may become disk-dominated late-type galaxies, if there are no further mechanisms to transport the molecular gas toward the central region thereby decreasing the disk size.

Wednesday, 9 July

09:30 Review

The influence of ram pressure on galaxy evolution and the multiphase ISM

Kenney, Jeff Yale University

I discuss ram pressure stripping as a mechanism for quenching star formation and driving galaxy evolution. The importance of stripping depends strongly on galaxy mass and environment, and is demonstrably important for low mass satellite galaxies sufficiently close to their host galaxy, and for even massive galaxies in massive clusters. Excellent examples of galaxies being ram pressure stripped in different nearby environments are examined. Recent studies have revealed much about the structure and evolution and star formation within ram pressure stripped gas tails, including the phenomena of fireballs and linear stellar streams. I explore the impact of ram pressure on the multi-phase ISM and the efficiency of stripping. The efficiency of ram pressure stripping depends on many factors, including the duration of ram pressure, the disk-wind angle, far side shielding, galaxy rotation, ISM substructure, and spiral structure. New studies strongly suggest that magnetic fields partially bind low and high density parts of the ISM during stripping, also affecting the efficiency of stripping. Finally, while many galaxies with quenched star formation may have been "starved", ram pressure stripping of halo gas may be an important starvation mechanism.

10:00 Contributed

The Local Cluster Survey: Probing Gas Stripping in Nearby Galaxy Groups and Clusters

Finn, Rose Siena College

The primary goal of the Local Cluster Survey is to measure the spatial extent of cold disk gas relative to the stellar disk for approximately 125 low-redshift ($z < 0.037$) group and cluster spiral galaxies to help identify the physical mechanisms that cause galaxies to evolve from blue, actively star-forming galaxies to red, passive galaxies. More specifically, environmentally-driven gas-depletion mechanisms are expected to preferentially remove gas from the outer radii of galaxies, so we are looking for signs that the gas is truncated relative to the stellar disk. The sample consists of 9 groups and clusters that span a range of X-ray luminosities, and all have optical photometry and spectroscopy from the SDSS, wide-field infrared 24-micron imaging from the Spitzer Space Telescope, and radio data from the ALFALFA survey. We find spiral galaxies with truncated 24 μm emission in all clusters, and the fraction of truncated spirals is higher in the clusters than in the field. The fraction of truncated spirals is highest at high local densities and low cluster-centric radii. We also find that galaxies with truncated 24 μm emission have enhanced nuclear emission as indicated by Hα. This work is supported by National Science Foundation grants AST-0847430 and AST-1211005.

10:15 Contributed

OMEGA: OSIRIS Mapping of Emission-line Galaxies in A 901/902

Rodriguez Del Pino, Bruno University of Nottingham

I will present results from an ongoing ESO Large Programme carried out using the OSIRIS instrument on the 10m GTC telescope (La Palma). We are observing a large sample of galaxies in the region of the Abell 901/902 system ($z \sim 0.165$) which has been extensively studied as part of the STAGES project. We are obtaining spectrally and spatially resolved H-alpha and [NII] emission maps for a very large sample of galaxies covering a broad range of environments. The new data are combined with extensive multi-wavelength observations which include HST, COMBO-17, Spitzer, Galex and XMM imaging to study star formation and AGN activity as a function of environment and galaxy properties such as luminosity, mass and morphology. The ultimate aim is to understand, in detail, the effect of the environment on star formation and AGN activity.

10:30 Invited

3D studies of galaxies in groups and other interacting systems

Mendes de Oliveira, Claudia University of São Paulo

The main topic of this talk is the study of galaxy formation and evolution in different environments of dense and loose groups based on the analysis of a large sample of compact groups and field galaxies observed with Fabry-Perot instruments. We have derived velocity maps, monochromatic and velocity dispersion maps for more than one hundred galaxies in compact groups to determine their evolutionary stages and these have been compared to data for galaxies in less dense environments, from the GHASP sample, for determination of the Tully-Fisher relation, search for tidal dwarf galaxy and young clusters, formed due to interactions, and to determine the mass profiles of galaxies and study of the cusp/core problem. Our main results will be discussed in this talk. In addition, we will quickly describe how the JPAS and SMAPS surveys, which are wide field optical surveys in 54 narrow band filters over 16k sq degrees of the sky, north and south, will revolutionize the study of groups and clusters and will give us a 3D picture of our nearby universe.

10:50 Contributed

Interplay between CO and [CII], and the suppression of SF in Compact Group galaxies: a Herschel and CARMA view

Alatalo, Katherine Caltech

Understanding the evolution of galaxies from starforming blue cloud objects into quiescent red sequence galaxies has been revolutionized by observations taken with the Herschel Space Observatory, allowing astronomers to probe both the cold dust as well as the cool ISM in a large set of galaxies, with unprecedented sensitivity. Recent Herschel observations of [CII], a known tracer of star formation, in Hickson Compact Groups of galaxies (HCGs) has shown that [CII] can also be highly excited in shocks. CARMA CO observations of these [CII]-bright HCGs therefore shed light on the impact of shocks on the excitation of the ISM, as well as the starforming (molecular) material. I will present preliminary results from our Herschel-CARMA combined observations of HCGs, which are able to tell us about the synergistic relationships between shocks, star formation and the cool ISM in the context of galaxy evolution.

11:35 Review

Models of AGN feedback

Combes, Françoise Observatoire de Paris, LERMA

The physical processes responsible of sweeping up the surrounding gas in the host galaxy of an AGN, and able in some circumstances to expell it from the galaxy, are not yet well known. The various mechanisms will be reviewed, QSO or radio modes, either momentum-conserving outflows, energy-conserving outflows, or both. They will be confronted to observations, to know whether they explain the M–σ relation, or whether they can also provide some positive feedback and be related to star formation.

12:05 Invited

Feeding and feedback in nearby active galaxies tracing co-evolution of SBMHs and galaxies

Storchi-Bergmann, Thaisa Instituto de Física, UFRGS

A fundamental role is attributed to supermassive black holes (SMBH) and their feedback in the evolution of galaxies. But theoretical models make broad assumptions about the physical processes involved, which occur when the SMBH is being fed in Active Galactic Nuclei (AGN). In search of constraints for these processes, we have been mapping the gas kinematics and stellar population properties of the inner few hundred parsecs of nearby AGN hosts on scales of 10–100 pc using integral field spectroscopy. I will present our results, showing gas inflows along nuclear spirals and disks. The inflow rates are much larger than the AGN accretion rate, suggesting that the excess gas is depleted via formation of new stars. Indeed, in many cases, we find $\sim$ 100 pc scale nuclear rings of recently formed stars that can be interpreted as signatures of co-evolution of the host galaxy and its AGN. Outflows are prevalent around the highest luminosity AGN, and are observed not only along the axis of highest ionization emission, but even perpendicular to it, or in a spherical shell, challenging the standard models of AGN.

12:25 Contributed

Investigating AGN/SB activities through ALMA multi-line observations in the mid-stage IR-bright merger VV114

Saito, Toshiki University of Tokyo

The importance of galaxy mergers in the context of galaxy formation and evolution have been clearly demonstrated in various numerical simulations. The violent merger event not only results in large scale morphological transformation and mass accumulation, but it also triggers gas compression, turbulence, and gas inflow to the galactic center region. We present high resolution CO(1-0), ^{13}CO(1-0), CO(3-2), HCN(4-3), HCO^+(4-3), CN(1-0), CS(2-1), CH_3OH(2-1), and CS(7-6) maps of an IR-bright mid-stage merger VV114 obtained during cycle 0 of ALMA. An unresolved strong HCN(4-3) source (< 200 pc) is detected at the nucleus of VV114E and has a high velocity dispersion (~ 290 km/s), and these features are also shown in HCO^+(4-3). These evidences suggest that this source has an obscured AGN. We also find a clumpy filament with resolved dense gas across the galaxy disks. This filament has several clumpy star-forming regions, and these clumps clearly show physical and chemical differences in our molecular line data. These new ALMA data demonstrated the importance of observing both the diffuse and dense gas in order to obtain a comprehensive view of the physical processes that occur during a major merger event.

12:40 Contributed

Possible evidence for the disappearance of the AGN torus at low luminosities

Burtscher, Leonard Max-Planck-Institut für extraterrestrische Physik

Theoretical studies suggest that low-luminosity AGNs are not able to sustain an obscuring torus. This holds both for tori that originate in an outflowing (wind) structure and for ones that are part of the accretion flow. So far, however, there is little evidence for a dependance of torus properties on AGN luminosity. Instead it seems that relations such as the mid-IR X-Ray correlation are unchanged down to about 10^{41} erg/s. We compiled a large (> 50 sources) sample of IFU data for AGNs that span a wide range in luminosities around the expected threshold. The sources are nearby so that we are sensitive to the dilution of the stellar features on small spatial scales. With this sample, we study the dilution of the stellar light, traced by the near-infrared CO absorption features, by the non-stellar continuum as a function of radius and find a change in the properties of the diluting continuum that happens very close to the expected threshold luminosity. We will discuss whether this supports predictions that the torus disappears at low luminosities.

12:55 Invited

The Siding Spring Southern Seyfert Spectroscopic Snapshot Survey (S7): Probing the Physics of Seyfert Galaxies using their Extended Narrow-Line Regions

Dopita, Michael RSAA, The Australian National University

I will describe results from the Siding Spring Southern Seyfert Spectroscopic Snapshot Survey (S7). This aims to investigate the physics of 100 southern Seyfert Galaxies through Integral Field Spectroscopy using the Wide Field Spectrograph (WiFeS). This survey of the central $38'' \times 25''$ of southern radio-detected Seyferts with $z < 0.02$ in the $350 - 710\,\mathrm{nm}$ waveband with $R = 7000$ in the red, provides the morphology, kinematics and the excitation structure of the extended narrow-line region, probes relationships with the black hole characteristics and the host galaxy, measures host galaxy abundance gradients and nuclear abundances from the HII regions. From photoionisation modelling, we determine the shape of the ionising spectrum of the AGN, discover whether AGN metallicities differ from nuclear abundances determined from HII regions, and probe grain destruction in the vicinity of the AGN.

13:15 Contributed

The Beauty and the Beast at the Core of a X-ray Luminous Cluster

Yuan, Tiantian RSAA Australian National University

We combine our new wide-field IFU observations with previous X-ray, radio and infrared observations to conduct a panorama study on the excitation processes happening at the core of the X-ray luminous cluster MACS J1931.8−2634 at redshift 0.352. Contrary to previous studies, we show that the majority of the Hα emission of the central region can not be accounted for by star formation. Using our most recent photoionization and shock models (MAPPINGS IV) we find that neither star formation nor X-ray excitation can explain the observed optical line ratios. We propose a shock interaction with the AGN jet to explain the observations.

Thursday, 10 July

09:00 Review

Galaxies on FIRE: Stellar Feedback Explains Inefficient Star Formation

Hopkins, Philip CalTech

Many of the most fundamental unsolved questions in star and galaxy formation revolve around star formation and "feedback" from both massive stars and accretion onto super-massive black holes. I'll present new simulations which attempt to realistically model the diverse physics of the interstellar medium, star formation, and feedback from stellar radiation pressure, supernovae, stellar winds, and photo-ionization. These mechanisms lead to 'self-regulated' galaxy and star formation, in which global correlations such as the Schmidt-Kennicutt law and the global inefficiency of star formation – the stellar mass function – emerge naturally. Within galaxies, feedback regulates the structure of the interstellar medium, and many observed properties of the ISM, star formation, and galaxies can be understood as a fundamental consequence of super-sonic turbulence in a rapidly cooling, self-gravitating medium. But feedback also produces galactic super-winds that can dramatically alter the cosmological evolution of galaxies, their behavior in galaxy mergers, and structure of the inter-galactic medium: these winds depend non-linearly on multiple feedback mechanisms in a way that explains why they have been so difficult to model in previous "sub-grid" approaches. Finally, I'll discuss how missing physics in these models might change our conclusions.

09:30 Contributed

The Star Forming Molecular Gas in Galaxies Near and Far

Narayanan, Desika Haverford College

The JVLA, PdBI and ALMA are revolutionising our view of star formation in both local and high-redshift galaxies. Galaxies at high z are seen to be exceptionally gas rich (compared to local analogues), with a Kennicutt-Schmidt star formation law with strongly varying star formation efficiencies. These observations rely critically on inferences made from the star forming molecular gas, whose emission is determined by small scale physics: radiative feedback from massive stars, supersonic turbulence and global gravitational collapse. I will present a model for the life cycle of giant molecular clouds in star forming galaxies as dictated by momentum input from massive stars, and global galaxy dynamical processes. From this model, we can recover the bulk physical properties of the molecular gas in both quiescent and starbursting galaxies which informs direct observables such as CO and HCN emission. I will utilise these results to present a general form for both the CO-H_2 conversion factor in star forming galaxies, as well as the origin of CO excitation ladders (SLEDs). This will have a critical impact on our understanding of galaxy gas fractions across cosmic time, the star formation law, and the results from CO deep fields.

09:45 Invited

Disk galaxies at high redshift: dynamics, star formation, and feedback processes

Bournaud, Fréderic CEA

Disk galaxies at high redshift ($z > 1$) have properties that largely differ from nearby spirals. They contain much higher gas densities, leading to strong disk instabilities driving rapid evolution. Star formation is relatively slow in the huge gas reservoirs, mostly because of regulation by ISM turbulence, and partly because of feedback processes. Detailed study of feedback processes suggest that the "giant clumps" formed by disk instability are relatively long-lived for the most plausible physical conditions, and clump migration can gradually grow a bulge until the disk is stabilized. Rapid gas infall at the highest redshifts may also help stabilize the disks and delay star formation. The disk instability, with or without long-lived clumps, drives a rapid gas infall toward the nucleus. This internal feeding mechanism is much more ubiquitous and efficient than in nearby spirals and can be a major contribution to supermassive black hole growth. The resulting AGN can be bright and, along with star formation, drive significant gas outflows, but leave star formation mostly un-affected in a long duty-cycle mode.

10:05 Contributed

Chemical enrichment by SN Ia in hydrodynamical simulations: different progenitor scenarios

Jimenez, Noelia Consejo Nacional de Investigacion Cientifica y Tecnica (CONICET)

The nature of the Type Ia supernovae (SN Ia) progenitors remains unknown. This is a major issue for galaxy evolution models since both chemical and energetic feedback play a mayor role in the gas dynamics, the star formation and stellar evolution. The progenitor models for the SN Ia now available in the literature propose different distributions for regulating the explosion times of these events. These functions are known as the Delay Time Distributions (DTDs). In this work we include for the first time in SPH simulations, five different DTDs for SNIa. We analyse the behaviour of the free parameter A which regulates the number of SN Ia, within a Single Stellar Population. In our simulations, A acts at a particle basis. We determine a value of A which reproduce the [α/Fe] ratios and their observed SN Ia rates for a pre-prepared galaxy in isolation. The calibrated scenarios are found to generate naturally a correlation between the specific SN Ia rate and the specific SFR which resemble closely the observational trends. Our results suggest that SN Ia observations on very low and very high SSFR of galaxies could help to set more stringent constrains on the DTDs.

10:20 Contributed

Dissecting Galactic Winds in Star-forming Galaxies

Ho, I-Ting Institute for Astronomy, University of Hawaii

For the first time, we show that we can cleanly separate three different gaseous components in star-forming galaxies by tracing their kinematics with integral field spectroscopy. We compare the emission-line ratios of different components with new predictions from our photoionization and shock models to investigate the galactic wind properties in massive star-forming galaxies. We show that galactic outflows can be cleanly identified using a combination of velocity dispersion, emission-line ratios, and velocity maps. We will present the first results of our application of this technique to the entire SAMI sample to investigate the fraction of shocked winds in star-forming galaxies. This is the first time such technique being applied on a statistical sample to unravel the prevalence of galactic winds in the local Universe.

11:05 Review

Star Formation at the peak of the galaxy formation epoch

Genzel, Reinhard Max Planck Institute for Extraterrestrial Physics

I will discuss the results of three major programs of studying star formation, cold gas, feedback and dynamics of massive 'normal' star forming galaxies near the peak of the epoch of galaxy formation ($z \sim 1-3$). Our observations, carried out with the IRAM Plateau de Bure interferometer and with two large instruments developed at MPE (the VLT near-IR integral field spectrometer SINFONI and the far-IR spectrometer/photometer PACS on Herschel) show that massive galaxies near the star formation–stellar mass 'main-sequence' were gas rich, highly turbulent and clumpy, disky systems with various degrees of rotational support. Star formation in these galaxies was plausibly driven by continuous, rapid accretion of gas and minor mergers from the cosmic web. The evolution of their disks and central bulges was probably strongly influenced by disk fragmentation and instabilities, as well as by powerful galactic outflows driven from the large star forming clumps. I will discuss the impact of these new observations on our understanding of galaxy evolution in the early Universe.

11:35 Invited

Galaxy growth at early times from 3D studies

Förster Schreiber, Natascha M. — Max-Planck-Institut f. extraterrestrische Physik

Spatially- and spectrally-resolved studies have provided new and unique insights into the physical and dynamical processes that drive the star formation and mass assembly of galaxies at intermediate to high redshift. I will present key results from near-IR IFU studies of $z \sim 1-3$ galaxies, including from the SINS/zC-SINF and KMOS^{3D} surveys with SINFONI and KMOS at the VLT, highlight synergies with observations at other wavelengths, and discuss the implications for early galaxy evolution from mass assembly to feedback processes.

11:55 Contributed

The dynamics and evolution of H-alpha star-forming galaxies since $z = 2.23$ with KMOS and SINFONI

Sobral, David Leiden Observatory/CAAUL Lisbon

I will present spatially resolved H-alpha dynamics of typical H-alpha-selected star-forming galaxies since $z = 2.23$ using the new KMOS IFU and SINFONI. The vast majority of the star-forming galaxies at all redshifts can be described by rotating disk models and we use the data to derive inclination corrected rotation speeds. Our H-alpha galaxies are well fitted by the $z \sim 1 - 2$ Tully-Fisher relation, confirming the evolution seen in the zero-point. We also investigate the morphologies of a much larger parent sample at $z = 0.4$, 0.84, 1.47, 2.23 using both HST/CANDELS and ground-base imaging and find consistent results in the disk/non-merger fraction we derive from our IFU observations. We conclude by showing that apart from the strong decrease in the typical SFR of galaxies, $\mathrm{SFR}_*(z)$ from high to low redshift, the properties of the overall star-forming population (dust extinction, metallicities and metallicity gradients, masses) reveal a remarkable non-evolution in the last 11 billion years.

12:10 Contributed

The growing processes of galaxies at high redshift: lessons from MASSIV and prospects with MUSE

Contini, Thierry Institut de Recherche en Astrophysique et Planétologie (IRAP)

Understanding the different mechanisms of galaxy assembly at various cosmic epochs is a key issue for galaxy evolution and formation models. I will present the results obtained within MASSIV (Mass Assembly Survey with SINFONI in VVDS), a survey with VLT/SINFONI aimed to probe the kinematics and chemical abundances of a unique sample of 83 star-forming galaxies selected in the redshift range $z \sim 1 - 2$. This large sample, spanning a wide range of stellar masses, is unique at these high redshifts and statistically representative of the overall galaxy population. In this talk, I will give an overview of the main results obtained within MASSIV and their implication on the different processes of galaxy assembly (smooth gas accretion, mergers, ...). The last part of this talk will be dedicated to prospects in this field using MUSE/VLT.

12:25 Contributed

Blowin' in the wind: both 'negative' and 'positive' feedback in an outflowing quasar at $z \sim 1.6$

Cresci, Giovanni INAF – Arcetri

Quasar feedback in the form of powerful outflows is invoked as a key mechanism to quench star formation in galaxies, although direct observational evidences are still scarce, probably because radiatively driven winds are rare as they arise during a short-lived phase. I will present X-Shooter and SINFONI observations of an obscured, radio-quiet QSO selected using such criterion, XID2028, in which we clearly resolve a fast (1500 km/s) extended (up to 13 kpc from the black hole) outflow in the [OIII] lines. This galaxy is observed at the peak epoch of galaxy and black hole assembly, where we expect to have the maximum influence of feedback on the evolution of the host galaxies. We derive a lower limit to the mass outflow rate of $\dot{M} > 1000 M_{\odot}$/yr, which implies a mass loading factor > 3. The high velocity and high mass outflow rate are unlikely to be sustained by star formation only. Interestingly, archive H+K band SINFONI observations and HST-ACS F814W imaging allow to map the current star formation in the host galaxy, through the narrow component of Hα emission and the rest frame U band flux. Both independent tracers show that the outflow position lies exactly in the center of a cavity in the star forming regions in the host galaxy. This suggests that the powerful outflow is removing the gas from the host galaxy ('negative feedback'), but also triggering star formation by outflow induced pressure at the edges ('positive feedback'). Therefore XID2028 represents the first direct detection of outflow induced star formation in a radio quiet AGN, as well as the first example of both types of feedback simultaneously at work in the same galaxy. Finally, I will briefly summarize the latest results of the AMAZE/LSD SINFONI survey of $z \sim 3$ LBGs, discussing the dynamics, metallicity and gas mass properties of these galaxies.

12:40 Contributed

Resolved stellar populations and the mass distribution within galaxies since $z \sim 2.5$

Wuyts, Stijn MPE

The Hubble Space Telescope and integral-field spectrographs on 8-m class telescopes have offered us an unprecedented view on the internal physics within high-redshift galaxies. Exploiting the powerful synergy between ACS and WFC3 imaging from CANDELS and grism spectroscopy from 3D-HST, I will present new insights on resolved stellar populations at $0.5 < z < 2.5$, bulge growth and quenching. I will further contrast the census of baryonic mass (and mass profiles) to dynamical constraints from imaging spectroscopy obtained at VLT as part of the KMOS^{3D} survey.

14:15 Review

Galaxy evolution in 3D: near and far

Kewley, Lisa RSAA, Australian National University

Throughout the history of the universe, shocks and large-scale gas flows have moulded the arms of spiral galaxies, formed the bulges of the most massive galaxies in the universe, fed supermassive black holes in the centres of galaxies, fuelled generation upon generation of new stars, and enriched the intergalactic medium with metals. I will present the latest results from our large 3D survey to understand the relationship between galactic-scale outflows, star-formation, and active galactic nuclei in galaxies as a function of environment and redshift. For local galaxies, we use multi-object integral field spectroscopy to build the largest sample of galaxies with wide 3-dimensional imaging spectroscopy. We probe the early universe by combining gravitational lensing with new infrared 3-dimensional imaging spectroscopic technology. Gravitational lensing allows us to probe the fundamental processes occurring within actively forming galaxies just 4 billion years after the Big Bang. In this lecture, I will present the latest results of our large survey to track how the star formation, chemical abundances, and galactic-scale outflows changed within galaxies over the past 11 billion years.

14:45 Contributed

The IFU View on Distant Disks: the Good, the Bad, and the Most Massive

Böhm, Asmus Institute for Astro- and Particle Physics Innsbruck

I will present first results of two recent VLT campaigns with VIMOS/IFU and SINFONI that focus on distant field disk galaxies. Our VIMOS project is a re-observation of galaxies at redshifts $z \sim 0.5$ that are part of a large sample previously observed with FORS using slit spectroscopy. We want to compare between the 2-D and the 3-D kinematics to test whether slit-based studies of the distant velocity-luminosity (Tully-Fisher) relation might be systematically biased. Our SINFONI observations target the most massive, morphologically undisturbed disk galaxies at redshift unity in the GEMS survey. Stemming from a small, well-defined cosmic volume, these galaxies can be used as a test bed of predictions from ΛCDM.

15:00 Contributed

The KMOS Kinematic Survey: The resolved Dynamics, Star-Formation and Chemical Properties of $z = 1 - 1.5$ galaxies

Stott, John Durham University

I will present the first results of K2S, a UK-led KMOS GTO survey to observe the redshifted H-alpha emission in star-forming galaxies at $z = 0.8 - 1.5$. Selecting galaxies from the star-forming "main-sequence" (stellar masses $10^{9.5} - 10^{11}$ and SFR $1 - 30\,M_{\odot}/\mathrm{yr}$), K2S will measure the resolved dynamics, chemistry and star formation in a statistical sample of galaxies in order to address: (i) How does the fraction of disks evolve as a function of z and environment? (ii) Are major (and minor) mergers more prevalent at high-z? (iii) How does the relation between the star-formation, stellar mass and dark halo evolve with z and environment? (iv) How does the angular momentum of galaxy disks evolve with z, stellar mass and environment? (v) Are chemical abundance gradients of early disks stronger or weaker than local spirals? These are critical issues for developing models of galaxy formation, in particular to determine if stellar mass assembly is dominated by secular evolution or via merger-induced growth.

15:15 Contributed

KMOS-3D: The Evolution of Resolved Kinematics and Star-Formation from Redshift 0.7 to 2.5

Wuyts, Eva Max Planck Institute for Extraterrestrial Physics

The KMOS-3D survey will provide near-IR IFU observations of a mass-selected sample of $\sim$ 600 star-forming galaxies at $0.7 < z < 2.5$ with the K-band Multi Object Spectrograph (KMOS) at the VLT. This talk presents kinematic results for a first sample of $\sim$ 200 galaxies, focusing on kinematic classification as well as the evolution of the gas velocity dispersion with redshift and as a function of galaxy properties. Additionally, measurements of the [NII]/Hα ratio are combined with multi-wavelength HST observations from CANDELS to address the relation between oxygen abundance, stellar mass, SFR and dust content. The IFU data allow us to spatially resolve [NII]/Hα to study abundance gradients and their evolution over cosmic time.

15:30 Contributed

Multiwavelength resolved spectroscopy of star forming galaxies at $z = 2 - 3$

Jones, Tucker UC Santa Barbara

Spatially resolved spectroscopy is even more powerful when combined with magnification by gravitational lensing. I will present observations of lensed galaxies at $z = 2 - 3$ with spatial resolution as fine as 100 parsecs in the source plane. Using near-IR integral field spectroscopy and adaptive optics we measure the kinematics, distribution and physical properties of star forming regions, and gas-phase metallicity gradients. Roughly two thirds of galaxies in our sample exhibit coherent velocity fields, large velocity dispersion, multiple giant star-forming regions, and negative metallicity gradients, suggestive of inside-out growth in gravitationally unstable disks. The remainder are undergoing mergers. All galaxies in our sample drive strong outflows, and we measure the physical properties of outflowing winds from moderate resolution spectra of absorption lines. This reveals their chemical composition, ionization state, and kinematics. I will also present preliminary results on the distribution and kinematics of molecular gas which drives the high star formation rates in these galaxies. Together these data constrain the growth of galaxies from mergers and star formation as well as the regulatory feedback from intense star formation.

15:45 Contributed

Probing Individual Star Forming Regions Within Strongly Lensed Galaxies at $z > 1$

Bayliss, Matthew Harvard University

Star formation occurs on physical scales corresponding to individual star forming regions, typically of order 100's of parsecs in size, but current observational facilities cannot resolve these scales within field galaxies beyond the local universe. However, the magnification from strong gravitational lensing allows us to measure the properties of these discrete star forming regions within galaxies in the distant universe. New results from multi-wavelength spectroscopic studies of a sample of extremely bright, highly magnified lensed galaxies are revealing the complexity of star formation on sub-galaxy scales during the era of peak star formation in the universe. We find a wide range of properties in the rest-frame UV spectra of individual galaxies, as well in spectra that originate from different star forming regions within the same galaxy. Large variations in the strengths and velocity structure of Lyman-alpha and P Cygni lines of Si IV, C IV, and even Mg II provide new insights into the astrophysical relationships between extremely massive stars, the elemental abundances and physical properties of the nebular gas those stars ionize, and the galactic-scale outflows they power.

16:30 Invited

ALMA surveys of high-redshift sub-mm galaxies

Swinbank, Mark Durham University

I will present some recent results from ALMA cycle 0/1 surveys of sub-mm galaxies (SMGs) taken from SCUBA-2 and LABOCA surveys. The ALMA data precisely locate the counterparts to the single-dish sub-mm sources, allowing us to investigate the properties of SMGs (redshift distribution, star formation rates, stellar masses and AGN activity) of large and unbiased sample. By combining multi-wavelength observations, I will show that these distant ($z \sim 2.5$) Ultra-luminous Infrared Galaxies have star-formation rates of $\sim 300\,M_\odot$/yr, substantial stellar masses ($M_* \sim 6 \times 10^{10}\,M_\odot$) and cold molecular gas fractions of $\sim 40\%$. Accounting for the fading of the stellar populations, the descendent space density of SMGs is consistent with the entire population of morphologically classified local luminous ellipticals. Finally, I will show some early results from ALMA cycle 1 where we have obtained higher resolution ($\sim 0.3''$) maps of a sub-sample of bright SMGs.

16:50 Contributed

Mapping and resolving galaxy formation at its peak epoch with Mahalo-Subaru and Gracias-ALMA

Kodama, Tadayuki National Astronomical Observatory of Japan

Our Mahalo-Subaru project has been mapping out star forming activities at the peak epoch of galaxy formation. We also show that the mode of star formation in dense environment is more burst-like and dusty compared to that in the field, due probably to galaxy-galaxy interactions. HST images from the CANDELS survey have revealed that nearly half of the Hα emitters in the field at $z \sim 2$ have clumpy structures, and among them "red dusty clumps" are preferentially found near or at the mass center of galaxies. They are probably linked to the formation of bulge component, and therefore this process is expected to depend on environment.To explore physical states and the mode of star formation of those forming galaxies, we have started Gracias-ALMA project in full coordination with the Mahalo-Subaru project. We will resolve molecular gas contents and dusty star formation within these galaxies, and tell whether clumps are formed by gravitational instability of gas rich disks, and whether bulges are formed by clump migration or through galaxy-galaxy mergers.

17:05 Invited

An Excess of Dusty Starbursts at $z = 2.2$

Dannerbauer, Helmut Universität Wien

Searching for massive, dusty starbursts offers the great opportunity to trace galaxy overdensities and thus the cosmic web in the distant universe. I will present our APEX-LABOCA 870 micron imaging of the proto-cluster field of the radio galaxy MRC1138–262 – the so-called Spiderweb Galaxy – at $z = 2.16$, uncovering a large number of so-called submm galaxies (SMGs). The number counts already indicate an excess of SMGs compared to blank fields. Based on an exquisite multi-wavelength dataset, I will show that a large fraction of these massive, dusty starbursts are physically associated with the proto-cluster at $z = 2.16$. Finally, I will discuss both the properties of this starburst overdensity and their individual members.

17:25 – Highlight talks

1 Highlight

Molecular gas, stellar and dust content in typical L_* galaxies at $z = 1 - 3$

Dessauges-Zavadsky, Miroslava — Geneva Observatory

Only recently have CO measurements become possible in $z = 1 - 2.5$ star-forming galaxies (SFGs), but are still biased (because of sensitivity limitations) towards objects with high SFRs and large stellar masses. Our multi-wavelength survey of massive galaxy clusters undertaken with Herschel, HST, Spitzer and ground-based telescopes allows us to overcome these observational limitations thanks to gravitational lensing. We present PdBI CO measurements for 7 strongly-lensed galaxies at $z = 1 - 3$, characterised by low intrinsic IR luminosities, $L_{\rm IR} < 4 \times 10^{11}\,L_\odot$, typical of L_* galaxies, and one order of magnitude smaller stellar masses, $M_{\rm stars} < 2 \times 10^{10}\,M_\odot$. Combining these molecular gas measurements with a careful SED analysis from optical to far-IR, we get a complete census of gas, star and dust properties for each of these L_* SFGs. Benefiting from the extended dynamical range in $M_{\rm stars}$ and SFR, with this new sample and the full sample of CO-detected SFGs from the literature, we revisit and propose new correlations between IR and CO luminosities, molecular gas, stellar and dust masses, SFRs, star formation efficiencies, gas depletion timescales, gas fractions, dust-to-gas ratios, and redshifts. These correlations betray the interplay between the gas and dust content and star formation in galaxies, and allow direct comparisons with model predictions.

2 Highlight

Jansky VLA S-band view of dusty starburst galaxies towards a protocluster surrounding 4C23.56 at $z = 2.48$

Lee, Minju — The University of Tokyo/NAOJ

We present early results from Jansky VLA deep S-band ($2 - 4$ GHz) observation to address characteristics of dusty starburst galaxies in a protocluster around radio galaxy 4C23.56. This protocluster was reported to be a volume over-dense region by our narrow band H-alpha emit-

ter(HAE) survey with Subaru. The follow-up observations of AzTEC/ASTE (1.1 mm) and PdBI (1.8 mm) revealed that HAEs are in the core of the protocluster and in the process of dusty star-forming. And some of the sub-millimeter galaxies(SMGs) detected by SPIRE/Herschel were overlapped with HAEs, implying heavily dust-obscured starbursts, yet those redshifts were poorly constrained. The aims of our JVLA observation are to (1) measure star formation rates of HAEs, (2) find physical associations of SMGs with the protocluster, pinpointing the HAE counterparts, (3) unveil star-forming galaxies in radio wavelengths. Analysis is based on sub-arcsecond high resolution imaging, spectral fitting, and stacking. Our results will allow us to evaluate biasing effects on galaxy formation in the over-density environment and can be combined with further follow-up atomic/molecular line observations using ALMA/JVLA, to investigate the detailed physical properties of galaxies in the protocluster.

3 Highlight

The formation of massive galaxies in the densest X-ray cluster environment at $z \sim 1.6$ as seen with 3D-Spectroscopy

Fassbender, Rene Observatory of Rome (INAF-OAR)

I will present new observational results on the galaxy population properties of the massive X-ray luminous galaxy cluster XDCP J0044.0−2033 at $z = 1.58$. The cluster core marks the highest density environment currently known at $z \sim 1.6$ and features rapid ongoing assembly activity of the most massive galaxies, a forming red-sequence, and a high level of cluster-central star formation activity. In particular, I will discuss the latest results based on a 3D-spectroscopic campaign with the new VLT/KMOS instrument with which these actively forming galaxies were targeted in order to provide a unique integral field spectroscopic view of the galaxy assembly process in cluster environments at a lookback time of 9.5 Gyrs.

4 Highlight

Early-type galaxy formation: understanding the role of the environment

Demarco, Ricardo University of Concepcion

One of the most characteristic features of galaxy clusters is the so-called "red sequence" (RS) that early-type galaxies form in the color-magnitude space of filters chosen to straddle the rest-frame 4000 Å-break feature in galaxy spectra. Since these galaxies are, in general, devoid of gas and dust, their red colors are mainly a consequence of their passive nature. The denser cluster core is dominated by these "red-and-dead" galaxies, some of them the most massive galaxies known. However, the physical mechanisms responsible for quenching their star formation, thus originating the RS, are poorly understood. Environmental effects should play a significant role in the formation of the RS by transforming the observed galaxy properties from late to early-type ones. However, the details of how this actually happens are still unclear. I will present part of the work in progress that our team is carrying out to better understand whether nature or nurture dominates in the formation of the RS. In this respect, I will briefly present our KMOS program aimed at studying the kinematical structure of cluster galaxies at $0.8 < z < 1.7$ in an effort to disentangle the physical mechanisms responsible for cluster galaxy evolution and the formation of the RS.

5 Highlight

Tracking galaxy growth with KMOS^{3D}

Wilman, David MPE

A complete picture of galaxy assembly requires not only accurate estimates of their mass and star formation across cosmic time, but also a picture of their stellar structure, and the location of ongoing star formation, and how this relates to the ongoing evolution of the star formation rate in individual galaxies from their time on the main sequence until the star formation dries up. Such a detailed picture of galaxies through the peak epoch in star formation requires resolved maps of the star forming gas at redshifts which put the key optical emission lines including Hα at near infrared wavelengths. With KMOS, the revolutionary multiplex-

ing NIR integral field spectrograph on the VLT, we have undertaken the KMOS^{3D} survey of > 600 mass-selected $z \sim 0.7 - 2.5$ galaxies to tackle these issues. First results will be highlighted in the presentation.

6 Highlight

Physics of Galaxy Color Migration

Cen, Renyue Princeton University

Utilizing state-of-the-art adaptive mesh-refinement cosmological hydrodynamic simulations, an analysis of the histories of a large sample of galaxies is performed and insights gained on how galaxies migrate from the blue cloud to the red sequence. It is found that ram-pressure stripping and cold gas starvation are both instrumental in driving galaxies' color migration, collectively termed environment quenching. The consequences from the environment quenching are in some cases quite intriguing and explained in this talk.

7 Highlight

Mock IFU observations of Lyman-alpha blobs, and Lyman-alpha halos around virtual galaxies

Verhamme, Anne University of Geneva

I will present our last results on spatially resolved Lyman-alpha spectroscopy of virtual galaxies, and groups of galaxies. First, I will present the spatial variation of Lyman-alpha spectra from one simulated blob around a group of galaxies, for two different mechanisms powering the Lyman-alpha emission, and compare the spectral characteristics with recent IFU observations of Lyman-alpha blobs. I will also present Lyman-alpha Equivalent Width maps, and their variations along several lines of sight. I will show maps of the velocity shifts between the Lyman-alpha peak and the systemic redshift of the blob, and discuss their correlations with velocity fields. Second, I will present the same study ($V_{\rm peak}$ maps, EW maps, spectral variability with radius versus inclination) for a vir-

tual dwarf galaxy isolated in its dark matter halo, as an extension of the work published in Verhamme et al. (2012).

8 Highlight

J-PAS: low-resolution ($R \sim 50$) spectroscopy covering 8500 deg^2

López-Sanjuan, Carlos CEFCA

In this talk we present the ambitious project J-PAS (Javalambre-PAU Astronomical Survey, www.j-pas.org), that will cover 8500 deg^2 of the northern sky with 54 narrow-band ($\sim$ 120 Å) contiguous filters and 5 broad-band filters, all of them in the optical range (3500 Å–9000 Å). J-PAS will provide a low resolution spectrum ($R \sim 50$) in every pixel of the northern sky by 2020, leading to excellent photometric redshifts (0.3% uncertainty) of 100 million sources down to $r = 23.5$. J-PAS will permit the study of the 2D properties of nearby galaxies with unprecedented statistics. Some viable studies are the distribution of the star formation rate traced by Hα, the stellar populations gradients in elliptical galaxies up to a few effective radii, or the impact of environment in galaxy properties. In summary, J-PAS will bring a superb data set for 3D analysis in the local Universe.

9 Highlight

NIKA2: a dual band KID based camera for mm wavelengths

Macias-Perez, Juan LPSC

We present here the NIKA dual band camera for mm wavelengths. NIKA consists of 400 KIDs (Kinetic Inductance Detectors) at 1.25 and 2.05 mm operated at 100 mK. NIKA is permanently installed at the IRAM 30 m telescope since 2012 and will be replaced by NIKA2, 5000 KIDs in total, beginning 2016. The high resolution and sensitivity of NIKA2 make it an ideal instrument for observations of high redshift dusty galaxies and cluster of galaxies. Its large field of view, 6.5 arcmin, allows also the detailed mapping of nearby galaxies.

Friday, 11 July

09:00 Invited

PHIBSS: Molecular Gas, Star-Formation and Scaling Relations at High Redshift

Tacconi, Linda Max-Planck-Institut für Extraterrestrische Physik

TBD

09:20 Contributed

A molecular scan in the Hubble Deep Field North

Decarli, Roberto MPIA

Deep, multi-wavelength surveys of galaxies have allowed us to constrain the growth of galaxies' stellar masses as a function of cosmic time. The emerging picture is that the rate of star formation in a given volume smoothly grows from high redshift, it peaks at $z \sim 1-3$ (the 'epoch of galaxy assembly') and then steeply decreases until $z = 0$. On the other hand, little is known about the evolution of the gaseous content of galaxies. In particular, molecular gas, which is the fuel for star formation, has been detected only in the brightest high-z sources (mostly quasar host galaxies and sub-mm galaxies), pre-selected because of their bright infrared emission. In this talk, I will present the first blind search for molecular gas emission in one of the best studied regions of the sky, the Hubble Deep Field North. We capitalize on a complete scan of the 3 mm transparent window of the atmosphere in order to look for carbon monoxide transitions. We have developed and applied various line searching algorithms, which allow us to discover 17 line candidates. I will present the most relevant candidates and the properties of their optical/NIR counterparts (when available). Most importantly, I will use the results of this study to put first constraints on the evolution of the CO luminosity function and the cosmic density of molecular hydrogen.

09:35 Contributed

The nature and assembly of primeval galaxies revealed by ALMA

Williams, Rebecca University of Cambridge

We report the detection of the [CII] line using ALMA in a faint galaxy at $z = 7.1$, well within the epoch of re-ionisation. This is the most distant far-IR detection so far. We find that the [CII] line (tracing the neutral medium) is much narrower than the Lyα emission (tracing the ionised medium). The [CII] emission is resolved on a scale of a few kpc and slightly offset relative to the Lyα-UV emission. Such features are indeed predicted by simulations of primeval galaxies. Our results reveal that this galaxy's medium is mostly photoionized by young stars, however satellite clumps of neutral gas have survived photoionization and can provide fuel for additional star formation. In addition, we investigate the properties of two more luminous systems observed with ALMA in [CII] at $z \sim 4 - 5$. In one of them, a powerful SMG, we clearly resolve a regularly rotating disk, although very unstable. In the other system (a QSO-SMG interacting system) we investigate satellite galaxies whose [CII] emission shows drastically different properties with respect to the ionised gas tracers. We will discuss the possible interpretations of these results, and the implications for our understanding of galaxy formation and assembly.

09:50 Invited

High redshift starburst galaxies revealed by SPT, ALMA, and gravitational lensing

Vieira, Joaquin University of Illinois at Urbana Champaign

The South Pole Telescope (SPT) has systematically identified a large number of high-redshift strongly gravitationally lensed starburst galaxies in a 2500 square degree cosmological survey of the millimeter (mm) sky. With ALMA, we have performed an unbiased spectroscopic redshift survey with these sources and determined that roughly 40% lie at $z > 4$. Two sources are at $z = 5.7$, placing them among the highest redshift starbursts known, and demonstrating that large reservoirs of molecular gas and dust can be present in massive galaxies near the end of the epoch of cosmic reionization. These sources were additionally targeted with high resolution imaging with ALMA, unambiguously demonstrating them to be strongly gravitationally lensed by foreground structure. With interferometric imaging of spectral lines, lens models, and the increased angular resolution afforded by the lensing magnification, we are able to construct detailed 3D pictures of these galaxies. We are undertaking a comprehensive and systematic followup campaign to use these "cosmic magnifying glasses" to study the infrared background in unprecedented detail, inform the condition of the interstellar medium in starburst galaxies at high redshift, and place limits on dark matter substructure. I will discuss the scientific context and potential for these strongly lensed starburst galaxies, give an overview of our team's extensive followup efforts, and describe our latest science results.

10:10 Contributed

Deep imaging with LOFAR and the the accretion history of AGN

Williams, Wendy Sterrewacht Leiden

At very low frequencies, the new pan-European radio telescope, LOFAR, is opening the last unexplored window of the electromagnetic spectrum for astrophysical studies. Operating between 15 and 240 MHz, its superb sensitivity, high angular resolution, large field of view and flexible spectroscopic capabilities represent a dramatic improvement over previous facilities at these wavelengths. LOFAR will carry out a broad range of fundamental astrophysical studies in a number of key science topics including the formation and evolution of clusters, galaxies and black holes. Here we will describe some of the capabilities of LOFAR and the planned LOFAR sky surveys. We will outline some of the challenges we have overcome in carrying out sensitive imaging and present some recent results from the ongoing imaging commissioning efforts. Finally we will discuss LOFAR's impact on our studies of Radio-Loud AGN. Radio-loud AGN come in two varieties: the cold mode accretors or classical quasars and the hot mode accretors where gas is accreted directly from a hot halo. Recently, we have found in the evolution of Radio-Loud AGN as a function of host stellar mass a clear increase in the fraction of lower mass galaxies which host Radio-Loud AGN at $z \sim 1-2$ while the fraction for higher mass galaxies remains the same. New low frequency observations with LOFAR will allow us to build statistically large samples at high redshifts to constrain this evolution for the different accretion modes.

10:25 Contributed

Discovery of Carbon Radio Recombination Lines in M 82

Morabito, Leah Leiden Observatory

Cold, diffuse HI clouds are a key component of the interstellar medium (ISM), and play an important role in the evolution of galaxies. Carbon radio recombination lines (CRRLs) trace this ISM stage, and with the enormous sensitivity of LOFAR we have already begun to map and constrain the physical properties of this gas in our own Galaxy. In order to understand how this phase of the ISM is involved in galaxy evolution, it is crucial to be able to observe CRRLs in extragalactic sources. I will present the first ever extragalactic detection of CRRLs. Using data taken with the LOFAR Low Band Antenna, we stack 22 lines to find a 3.3-σ detection. The peak line to continuum ratio is ~ 0.003, and the line profile exhibits both a shallow, broad component and a deeper, narrower component. The line parameters are consistent with the cold, diffuse gas in which we see CRRLs in our own Galaxy. I will discuss the potential of using CRRLs as a redshift-independent tracer of the cold neutral medium, as well as how CRRLs can be used to provide spectroscopic redshifts.

11:10 Review

The cosmological formation of massive galaxies

Naab, Thorsten MPA

I will review recent progress and future developments on theoretical aspects of the formation of massive galaxies and direct connections to observational surveys.

11:40 Contributed

Formation of disc galaxies in the Magneticum Pathfinder simulations

Remus, Rhea-Silvia University Observatory

I present a new set of state-of-the-art, hydrodynamical cosmological simulations called Magneticum Pathfinder. These simulations treat all important physical processes self-consistently, especially the chemical and thermodynamical evolution of the diffuse gas component together with the evolution of the stellar and AGN component, including their corresponding chemical and energetic feedback. In our cosmological boxes we self-consistently form a population of disc galaxies as well as a population of elliptical galaxies. In this talk I present the dynamical properties of our disc galaxies, in particular I will show studies of their scale height, their density and rotational velocity profiles and their spin parameters. Most interestingly, I will discuss a dichotomy found in the total angular momentum distribution of our galaxies, and present first evidence for the importance of gas-rich mergers on the formation of disc galaxies. Furthermore, I will provide a comparison of those properties to observations.

11:55 Contributed

Virtual IFUs: The spatial location of star formation in simulated merging galaxies

Moreno, Jorge University of Victoria & CITA

With the advent of integral field spectroscopy, upcoming surveys will soon be able to produce maps of a reasonably large population of galaxies with exquisite detail. In this talk I will present preliminary results from ongoing work based on high-resolution hydrodynamical merger simulations. Our aim is to understand how the spatial distribution of star formation evolves in merging galaxies as the interaction process unfolds. Variables like gas fraction, mass ratio, relative orientation and the orbital geometry of the encounter are considered. In particular, we find that the star formation rate profiles become shallower in galaxies experiencing an encounter. And whilst this effect is actually triggered at pericentre, it reveals itself with a delay of about 1 Gyr, making it observable until near the apocentre of the orbit. We also find that star formation is more prevalent in tidal tails at this stage of the interaction. This theoretical framework aims to mimic the IFU fibres used in ongoing and upcoming IFS surveys – such as CALIFA, MaNGA and SAMI (to name a few). These simulations will help us tease the role of mergers and interactions in establishing the internal structural properties of galaxies, bridging the gap between the sub-galactic realm and larger scales (i.e. those pertaining to galaxy environment).

12:10 Contributed

Cold streams: detectability and characteristics

Goerdt, Tobias Universität Wien

Cold gas streaming along the dark-matter filaments of the cosmic web is predicted to be the major provider of resources for disc buildup, violent disk instability and star formation in massive galaxies in the early universe. We use high-resolution cosmological hydrodynamical adaptive mesh refinement (AMR) simulations to study to what extent these cold streams are traceable in the extended circum-galactic environment of galaxies via Lyα emission, Lyα absorption and selected low ionisation metal absorption lines. We predict the strength of the absorption signal and find that the Lyα absorption profiles produced by the streams are consistent with observations of absorption Lyα profiles in high redshift galaxies. Due to the low metallicities in the streams, and their low covering factors, the metal absorption features are weak and difficult to detect. The characteristics of the Lyα emission of our simulated Lyα blobs (LABs) are similar in luminosity, morphology and extent to the observed LABs, with distinct kinematic features. The predicted Lyα luminosity function is consistent with observations, and the predicted areas and linewidths roughly recover the observed scaling relations. This mechanism for producing LABs appears inevitable in many high-z galaxies. Some of the LABs may thus be regarded as direct detections of cold streams. We analyse the characteristics of the cold streams in simulations and present scaling relations for the amount of infall, its velocity, distribution and its clumpiness and compare our findings with observations.

14:00 Review

Galaxy Mass Assembly with E-ELT/MOSAIC and lessons from the VLT & HST IMAGES Survey

Hammer, François Observatoire de Paris

The combination of high spatial resolution from space and 3D spectroscopy from ground is a remarkable tool to dissect distant galaxies and their internal motions. Combining JWST/NIRCAM and E-ELT/MOS (MOSAIC) will capture what are the physical processes dominating the formation of the first galaxies. Representative samples of galaxies at different epochs can be gathered for a follow-up of their properties all the way from $z \sim 7$ to $z = 0$. Such a combination has been already experienced with HST/ACS and VLT/GIRAFFE & SINFONI, establishing the evolution of the Hubble Sequence since the last 8 billion years. It has shown the importance of the disk formation in galaxies within the Milky Way mass range. The impact of mergers has been also re-evaluated solving the long-standing problem of the disk survival and perhaps, the angular momentum crisis. Consequences to the formation of the Milky Way and M31 disks, of Local Group dwarves will be then described.

14:30 Review

The Hector survey: an integral field spectrograph survey of 100,000 galaxies

Bland-Hawthorn, Joss University of Sydney

Over the past six years, we have developed and demonstrated a new photonic technology – the hexabundle – a special imaging fibre bundle designed to replace individual fibres in multi-object spectrographs. This technology lies at the heart of the newly commissioned SAMI instrument at the AAT which offers 13 bundles over a one-degree field (Croom et al., 2011). SAMI has already observed more than 1000 galaxies as part of a 3000 galaxy survey. We are now moving beyond the SAMI prototype towards a much larger concept known as Hector. This will feature 100 hexabundles and robotic (starbug) positioning over a two-degree field at the AAT. We propose to trace galaxy properties over large-scale structure in unprecedented detail, in particular, mass and angular momentum correlations with environment.

15:00 Invited

Measuring Gas Accretion and Outflow Signatures with MaNGA

Tremonti, Christy University of Wisconsin-Madison

A central issue in galaxy evolution is understanding the 'baryon cycle', namely how gas is accreted onto galaxies and expelled in galactic winds. I will discuss how nebular metallicity gradients can be used to constrain these processes and I will highlight the importance of obtaining gradient measurements for large statistical samples of galaxies spanning a broad range of physical properties (SFR, mass, B/D ratio, environment). I will describe the SDSS-IV MaNGA survey, which will obtain spatially resolved spectra of $\sim$ 5000 disk galaxies beginning in fall of 2014. I will show some early results from the commissioning data and discuss the advantages and challenges of using MaNGA data for this work.

Posters

1 Poster

Bar pattern speed through the Hubble sequence

Aguerri, J. Alfonso L. Instituto de Astrofisica de Canarias

The bar pattern speed is defined as the rotational frequency of the bar, and determines the bar dynamics. In this talk I will give an overview of the different methods used in the literature for the determination of the bar pattern speed. I will focus the rest of the talk in the nonparametric method proposed by Tremaine & Weinberg (1984; TW) based on stellar kinematics. This is so far the most accurate method for the determination of the bar pattern speed. Integral field kinematics is ideal for the application of this method. Because it gets rid of many of the problems of the long-slit spectroscopy such as centering, positioning, number of slits, resulting the determination of the patter speed more accurate. We have applied the TW method to a new sample of 15 strong and bright barred galaxies, spanning a wide range of morphological types from SB0 to SBbc from the CALIFA sample. Combining our analysis with previous studies we present, in this talk, the results of 32 barred galaxies with their pattern speed measured by the TW method. The resulting total sample of barred galaxies allows us to study the dependence of the pattern speed on galaxy properties as the Hubble type. Our results indicate that independent of the Hubble type bars have been formed and evolve as fast rotators. Bar formation is a complex and multiparametric process. The bar pattern speed is one of the most important parameters of the bars. This observational result will strongly constrain the scenarios of formation and evolution of bars proposed by numerical simulations.

2 Poster

The relation between gas, dust and total mass in edge-on spiral galaxies

Allaert, Flor Ghent University

The gas-to-dust ratio is a key diagnostic in understanding the chemical evolution of galaxies. Unfortunately, a solid measurement of this ratio is generally hampered by the difficulty to accurately determine the distribution of the interstellar dust. In edge-on galaxies, however, the dust is not only seen in emission, but also in absorption, making it possible to model their 3D dust distribution using reliable radiative transfer models. We present the HEROES project, an analysis of 7 nearby edge-on spiral galaxies, based on a multi-wavelength data set including optical, NIR, FIR and radio data. We combine a detailed determination of the dust distribution with 3D kinematical models of the gas content to measure the radial variation of the gas-to-dust ratio, out to large galactocentric radii. We also test the reliability of using FIR emission as a tracer for the total ISM distribution in galaxies, and we explore the possibility of a universal dust-to-total mass ratio.

3 Poster

Can we detect the kinematic signature of galaxy mergers at high redshift?

Amram, Philippe Laboratoire d'Astrophysique de Marseille

The contribution of the fusion processes to the cosmological mass assembly is still poorly understood. In this context, the study of the dynamical support of galaxies is a way to constrain different evolution scenarios. Using the kinematical analysis of galaxies MASSIV sample that consists of 83 young galaxies ($1 < z < 2$) observed with the integral field spectrograph SINFONI at the VLT, I will present the last results in order to determine the ability to detect galaxy merger signatures.

4 Poster

The Structure and Kinematics of the ISM in Star-forming Galaxies at $z \sim 2$

Baba, Junichi Earth-Life Science Institute, Tokyo

We performed N-body/hydrodynamic simulations of $z \sim 2$ star-forming galaxies to investigate the kinematic properties of the ISM in different thermal states. We adopted a non-equilibrium radiative cooling by solving the non-equilibrium chemistries of atoms H, He, C and O and molecules H_2 and CO. Additionally, we took into account radiative heating, star formation, HII region formation, and supernova explosions. Our simulations predict that the highly turbulent gas disks observed by Hα emissions are driven by star-formation feedbacks. The velocity dispersion correlates with the star formation rates and this is consistent with recent observations. However, the molecular gas of high-z star-forming galaxies would not be highly turbulent and its velocity dispersion also correlates with star formation rates up to $\sim 10 - 20\,\mathrm{km/s}$. Finally, we discuss the future ALMA observations of the cold gas in high-z star forming galaxies.

5 Poster

Gas and Stellar Properties of Galaxies in Cosmological Hydrodynamical Simulations

Barai, Paramita INAF - Osservatorio Astronomico di Trieste

I will report our ongoing development and performance of cosmological hydrodynamical simulations, and subsequent analysis of simulated galaxy and circumgalactic medium (CGM) properties. Feedback from star formation (SF) and supernova (SN) explosions as mass/energy ejection play crucial roles in the build up of large-scale structures. The incorporation of such sub-pc scale baryonic physics in kpc's resolution galaxy simulations is computationally challenging, because of the large dynamical range in mass, length and time scales; hence improving such sub-resolution recipes is important. We numerically implement two novel baryonic feedback models in the 3D TreePM-SPH code GADGET-3: energy feedback from SN-driven galactic outflows (Barai et al. 2013, MNRAS, 430, 3213), and the MUPPI model of SF (Murante et al. 2010,

MNRAS, 405, 1491). Using these models we simulate cosmological volumes, also including radiative cooling, SF, and chemical enrichment. The impact of different feedback mechanisms on the global properties are analyzed: redshift evolution of the SF rate density, gas and stellar mass functions, metal enrichment of the CGM and IGM, radial profiles of gas properties (density, temperature, metallicity) around galaxy centers over $z = 2 - 4$; and where possible confronting those with observations. Results from such studies will be presented.

6 Poster

Continuous Mid-Infrared Star Formation Rate Indicators

Battisti, Andrew University of Massachusetts at Amherst

We present continuous, monochromatic star formation rate (SFR) indicators over the mid-infrared (MIR) wavelength range of $8 - 70\,\mu$m. We use a sample of 55 star forming galaxies in the Spitzer-SDSS-GALEX Spectroscopic Survey (SSGSS) at $z < 0.2$, for which there is a rich suite of multi-wavelength photometry and spectroscopy from the ultraviolet through to the infrared. The data from the Spitzer infrared spectrograph (IRS) of these galaxies, which spans $5 - 40\,\mu$m, are anchored to their photometric counterpoints and then calibrated as a SFR indicator using several reference SFR indicators. The spectral region between $40 - 70\,\mu$m is interpolated using dust model fits to the IRS spectrum anchored by Spitzer 70 and 160 mum photometry and is also calibrated as a SFR indicator. Since there are no sharp spectral features in this region, we expect these interpolations to be robust. We compare our continuous, monochromatic SFR indicator to recent calibrations of the WISE 12 and 22 μm bands in order to check consistency. We discuss the range of validity and applicability of our SFR indicator in the context of unveiling the formation and evolution of galaxies. Additionally, in the era of the James Webb Space Telescope (JWST) this will become a flexible tool to be applied to any galaxy up to $z \sim 3$.

7 Poster

Black hole – host galaxy coevolution in nearby low-luminosity type-1 QSOs

Busch, Gerold I. Physikalisches Institut der Universität zu Köln

The properties of the host galaxies of quasi-stellar objects (QSOs) are essential for the understanding of the suspected coevolution of central supermassive black holes (BHs) and their host galaxies. Here, I show a study of $\sim$ 20 low-luminosity type-1 QSOs (LLQSO) that have been selected from the Hamburg/ESO survey for bright UV-excess QSOs ($z \leq 0.06$). Performing careful decomposition of deep near-infrared J,H,K images, we found that the observed sources do not follow published $M_{BH} - L_{\rm bulge}$ relations for inactive galaxies, supporting similar results found for type-1 AGN in the optical. This can be explained by overluminous bulges with very young stellar populations or undermassive black holes that are observed in a phase of growth. We use 3d-spectroscopy in the optical and near-infrared as a powerful tool to trace underlying stellar continuum and thereby constrain possible evolution scenarios. The results are interpreted in the context of galaxy evolution and particularly the still unknown role of the AGN in this process.

8 Poster

Black Hole Growth and Galaxy Evolution in $z \sim 0$ Mergers. Initial Results

Calderon, Paula Universidad de Concepcion

With the goal of better understanding galaxy evolution, we are studying a large sample of galaxy mergers covering a range of interaction stages. The sample consists of 3003 galaxy mergers selected from the Galaxy Zoo project, which uses citizen scientists to visually classify galaxies from SDSS imaging. We are using existing multiwavelength (UV, IR, radio) data to test the evolution of star formation rates and black hole feeding and feedback along the merger sequence and for comparison to control samples of isolated galaxies and QSO host galaxies. We further concentrate on the subsample with the deepest optical imaging: the $\sim$ 150 galaxy mergers located in SDSS Stripe 82. For this subsample we have commenced detailed optical integral field unit (IFU) studies –

for ionized gas and stellar kinematics and stellar population analysis – and ALMA studies – molecular gas kinematics and inflows/outflows. The large sample size allows us to better test the evolutionary scenario proposed for mergers: merger *rightarrow* ULIRGs $\rightarrow$ obscured QSO $\rightarrow$ QSO $\rightarrow$ elliptical galaxy. In this poster we will present the initial results of this project.

9 Poster

Fabry-Perot spectroscopy: a powerful method for detecting superbubbles in galaxy discs

Camps-Fariña, Artemi Instituto Astrofisico de Canarias

We present a new method for the detection and characterization of large scale expansion in galaxy discs based on H-alpha Fabry-Perot spectroscopy, taking advantage of the high spatial and velocity resolution of our instrument (GHaFaS). The method analyses multi-peaked emission line profiles to find expansion along the line of sight on a pixel-by-pixel basis. At this stage we have centered our attention on the large scale structures of expansive gas which show a coherent gradient of velocities from their centers as a result of both bubble shape and projection effect. The results show a wide range of expansion velocities in these superbubbles, ranging from $\sim 30 - 150\,\mathrm{km/s}$, with the expected trend of finding the higher velocities in the more violent areas of the galaxies. We show examples of the expansion maps obtained with our method, focusing on the spectacular results from the Antennae and M 83. We investigate to what extent kinematically derived ages can be found and used to characterize the ages of massive star clusters.

10 Poster

Kinematic properties of superbubbles in the Antennae, M 83 and Arp 270

Camps-Fariña, Artemi Instituto Astrofisico de Canarias

Superbubbles and large scale expansion in galaxies are very important indicators of activity in galaxies, as they are formed in starbursts and violent nuclear activity. Superbubbles can also give useful information on the star-forming region that produced them. We present in-depth results of our study of kinematically detected superbubbles using a method based on Fabry-Perot spectroscopy, which allows us to map regions of expansion across the entire disk of a galaxy. Three objects have been selected for this poster based on the interest of the results they show: two interacting galaxies, the Antennae and Arp 270, at different stages of glaaxy interacion, and the more isolated galaxy M 83. We present the kinematic expansion maps, as well as a census of detected superbubbles and a dynamical study of their properties.

11 Poster

Star Formation in the Local Universe from the CALIFA sample: calibration and contribution of disks to the SFR density

Catalán-Torrecilla, Cristina Universidad Complutense de Madrid

The measurement of the star formation rate (SFR) is crucial for understanding the birth and evolution of the galaxies (Kennicutt 1998) as it provides information on the amount of gas in galaxies and the efficient in the formation of stars inside them. In the first part of this work, we make use of a large and well-characterized sample of 380 nearby galaxies from the CALIFA survey that span the entire color-magnitude diagram. We derived integrated extinction-corrected Hα-based SFRs from the analysis of CALIFA IFS in order to compare them with single and hybrids tracers at other wavelengths found in the literature (Calzetti 2013, Hao et al. 2011, Kennicutt et al. 2009), namely the integrated UV-observed + 22 μm, UV-observed + TIR, Hα-observed + 22 μm, or Hα-observed + TIR. Then, we provide updates SFRs tracers using our integrated extinction-corrected Hα SFR as a reference, thanks to the quality of our attenuation correction via Balmer decrement. Only once these ef-

fects are properly accounted for we can explore the spatial distribution of the star formation. We obtain preliminary results from the spatially-resolved analysis of the contribution of disks to the total SFR in the Local Universe, as a local benchmark for future studies of disks at high redshift. Our analysis shows that the disk to total (disk + bulge) SFR ratio is on average $\sim$ 88%. The use of the 2D spectroscopic data is critical to properly determine the Hα luminosity function and SFR density in the Local Universe per galaxy components, the ultimate goal of this project.

12 Poster

Escape of ionizing photons during reionization: effects due to supernovae and runaway O/B stars

Cen, Renyue Princeton University

The escape of hydrogen ionizing photons is the critical ingredient in the theory of reionization. We use two zoomed-in, high-resolution (4.2 pc), cosmological radiation hydrodynamics simulations with adaptive mesh refinement to investigate the impact of two physical mechanisms (supernova feedback and runaway O/B stars) on the escape fraction $f_{\rm esc}$ during reionization ($z > 7$). Supernova feedback causes the SFR and $f_{\rm esc}$ to become out of phase by about 10 million years. As a result, integrated $f_{\rm esc}$ is about 11%, although instantaneous $f_{\rm esc}$ often could be 30% or higher. We also find that the inclusion of runaway stars increases the integrated escape fraction to $f_{\rm esc} = 14\%$. Enough photons are escaped to keep the universe ionized at $z = 7$ in our simulations, consistent with observations. Nevertheless, more photons (a factor of a few) are needed to be consistent with the measured Thomson optical depth by CMB observations, suggestive of other missing physics in our treatment.

13 Poster

The Assembly Histories of Quiescent Galaxies since $z = 0.8$ from Absorption Line Spectroscopy

Choi, Jieun UC Santa Cruz

We present results from modeling the optical spectra of a large sample of quiescent galaxies between $0.1 < z < 0.7$ from the Sloan Digital Sky Survey (SDSS) and the AGN and Galaxy Evolution Survey (AGES). We examine how various stellar population properties evolve over time as a function of mass from $10^{9.8}\,M_{\odot}$ to $10^{11.5}\,M_{\odot}$. Galaxy spectra are binned in mass and redshift, and the stacked spectra are modeled over a wavelength range from 4000 Å to 5500 Å to measure the elemental abundances and the light-weighted age. We find negligible evolution in abundances at fixed M_* over roughly 7 Gyr, which indicates that there is very little temporal evolution. Our results are consistent with the scenario in which the central regions of massive quiescent galaxies have evolved passively over half the age of the Universe. When combined with other work, these results provide strong and independent evidence for "inside out" growth of massive elliptical galaxies.

14 Poster

3D-structure of galactic disks

Chudakova, Ekaterina Sternberg Astronomical institute of the Lomonosov Moscow State University

We have proposed a new photometric method to estimate thicknesses of galactic disks which is working for the galaxies seen under arbitrary inclination. We stress two distinct advantages of our method: firstly, it provides an individual estimate for every galaxy, beyond a statistical approach, and secondly, for the galaxies which orientation differs from edge-on it allows to confront its vertical structure with the radial brightness profile properties. We have applied our method to two small samples of disk galaxies which radial brightness profiles have been already analysed in the literature: to the r-band SDSS images of the galaxies which radial structures are described by Erwin et al. (2008) and Gutiérrez et al. (2011) and to the 3.6- and 4.5-μm images made by the space telescope Spitzer and collected in the Spitzer Survey of Stellar Struc-

ture in Galaxies (S4G). The radial structures of the latter sample are partly described by Munoz-Mateos et al. (2013). We have obtained significantly different thickness distributions for the purely exponential-profile galactic disks and for the antitruncated stellar disks.

15 Poster

Metallicity gradients in the Milky Way thick disk as dynamical relic of a primordial chemical distribution

Curir, Anna Astrophysical Observatory of Turin

We examine the evolution of the radial metallicity gradient induced by secular processes, in the disk of an *N*-body Milky Way-like galaxy. We assign a [Fe/H] value to each particle of the simulation according to an initial, cosmologically motivated, radial chemical distribution and let the disk dynamically evolve for 6 Gyr. This direct approach allows us to take into account only the effects of dynamical evolution and to gauge how and to what extent they affect the initial chemical conditions. The final radial chemical gradients predicted by the model in the solar neighborhood are positive and of the same order of those recently observed in the Milky Way thick disk. We conclude that the spatial chemical imprint at the time of disk formation is not washed out by secular dynamical processes, and the observed radial gradient may be the dynamical relic of a thick disk originated from a stellar population showing a positive chemical radial gradient in the inner regions.

16 Poster

Resolving the flows around black holes

Curtis, Michael Institute of Astronomy

We address significant shortcomings of using a Bondi-Hoyle-like prescription to estimate black hole accretion in cosmological hydrodynamic simulations of galaxy formation. We describe and implement a novel scheme to increase spatial resolution in the targeted regions around the

accreting black holes at limited computational cost, thus effectively resolving their Bondi radii in full galaxy formation simulations. We outline a black hole accretion rate prescription using a modified Bondi-Hoyle formulation that takes into account the angular momentum of the surrounding gas. Meaningful implementation of this modified Bondi-Hoyle formulation is only possible with our novel spatial refinement scheme where gas angular momentum distribution is well resolved down to the relevant scales. We investigate the effects of these different techniques by implementing them in simulations of isolated disc galaxies using the moving-mesh code AREPO, finding that the gas angular momentum barrier can play an important role in limiting the growth of black holes.

17 Poster

Separating the signatures of star-formation and AGN activity in composite galaxies

Davies, Rebecca Australian National University

One of the greatest unsolved mysteries in astrophysics is the relationship between star formation and AGN activity in composite galaxies. The ability to study spatially-resolved star formation rates in AGN dominated galaxies would provide significant insight into this issue; however, such studies have largely been impossible due to the strong contamination of optical star formation indicators by emission from the AGN. To address this problem, we use optical Integral Field Unit (IFU) data to investigate the variation in the diagnostic [NII]/Hα and [OIII]/Hβ ratios as a function of radius in starburst–AGN composite galaxies. We consistently observe clear and distinct rings of gas ionised by increasing fractions of AGN activity as radius decreases. We use our data to robustly estimate the relative contribution of star-formation and AGN activity to their EUV radiation fields, globally and on a spaxel-by-spaxel basis, and to estimate narrow line region radii. Our analysis paves the way for a thorough investigation into radial variations in star-formation rate and the properties of the interstellar medium in composite AGN/star-forming galaxies.

18 Poster

3D radiative transfer modeling and multi-wavelength decomposing of edge-on spiral galaxies

De Geyter, Gert Universiteit Gent

Among spiral galaxies, the ones seen from a near edge-on view have the distinct advantage that the main components can be identified separately; the stellar disk, the bulge and the dust disc. We present the results of a detailed radiative transfer study of 12 edge-on galaxies selected from the CALIFA survey. FitSKIRT, a code to fit radiative transfer models to optical and NIR images of dusty galaxies, is used to recover the 3D distribution and spectral properties of dust and stars in each galaxy. These models serve as an input to construct the entire SED using a full panchromatic radiative transfer simulation. As a final step we compare our predicted MIR/FIR fluxes to the actual observed values. The problems and implications of these findings on the dust energy balance in spiral galaxies are discussed.

19 Poster

High-resolution, 3D radiative transfer modeling of M 51

De Looze, Ilse Ghent University, Sterrenkundig Observatorium

Panchromatic studies of the dust energy balance in galaxies based on high-resolution 3D radiative transfer calculations provide the best machinery to constrain the amount, spatial distribution and properties of dust grains in a galaxy's ISM. Up to date, radiative transfer models were restricted to edge-on galaxies, for which dust energy balance studies revealed an inconsistency in the sense that radiative transfer predictions based on optical constraints underestimate the FIR/submm emission by a factor of three to four. This inconsistency suggests that the dust is distributed in compact clumps that have a negligible contribution to the large-scale UV/optical extinction. We present a self-consistent, 3D radiative transfer model for the nearby face-on galaxy M 51, based on a combination of Herschel, Spitzer, GALEX, WISE and ground-based optical imaging data. High-resolution, 3D radiative transfer calculations allow us to evaluate the dust energy balance in M 51 and, hereby, better constrain the distribution, clumpiness and composition of grain species

in M 51. We, furthermore, analyze the 3D spatial structure of stars and dust in M 51 and characterize the main dust heating mechanisms at every specific location within the galaxy.

20 Poster

Galaxy evolution in high-z proto-groups

Diener, Catrina ESO Vitacura

The zCOSMOS-deep survey contains 3500 galaxies with spectroscopic redshifts between $2 < z < 3$. We devised a group-finder that takes into account the large measurement uncertainties at this redshift and identified 42 proto-groups in this redshift range. I will discuss both the evolution of structures like these as seen in simulations as well as how the proto-group environment impacts on galaxy properties from an observational point of view. As a special case I will present a redshift $z = 2.5$ proto-cluster with (to date) 11 spectroscopically confirmed members, one of the furthest such structures known by today. This system provides an insight into how extreme environments impact star-formation rates and the masses of member galaxies. We contrast this finding with a theoretical perspective, by appealing to various semi-analytic models of galaxy formation. By comparing the evolution of synthetic galaxies against our observations, we can draw conclusions on the validity of these models.

21 Poster

The connection between structure and stellar population in early-type galaxies

D'Onofrio, Mauro University of Padua

We show that a connection between structure and stellar population in early-type galaxies is easily predicted by the virial theorem and the observed Fundamental Plane. The WINGS data indicate that the FP tilt is drived by the ETGs non-homology and that a connection between

mass-to-light ratio M/L, Sersic index n and galaxy mass M can be observed. The physical relation between structure and stellar population is the key to understand the FP tilt and scatter. The existence of such relation can be understood if ETGs are subject to multiple dry merging events of minor bodies.

22 Poster

Decoding 3D Edge-On Galaxy Morphology with Optical Spectroscopy

Eigenbrot, Arthur University of Wisconsin, Madison

Two-dimensional spectral coverage of edge-on galaxies reveals substantial deviations in emission line shapes from a purely gaussian profile that vary with radius and height. Non-gaussianity is quantified using statistical moments up to fourth order. We can infer the line-of-sight density distribution by comparing our measured line profiles to synthetic line-of-sight velocity distributions from a suite of three-dimensional galaxy models. With this method we are able to measure global morphologies in edge-on galaxies and estimate the circular speed of their potentials as a function of radius and height. We apply this method using long-slit data to nearby edge-on galaxy ESO 435-G25 and discuss the possibility that we are seeing disk-flaring in ionized gas, and implications of this interpretation for the apparent decrease of the gas tangential speed with scale-height. We describe how these measurements will be extended using GradPak, a novel variable-pitch fiber IFU now commissioned on the WIYN 3.5m Telescope.

23 Poster

Deep Hα imaging of Southern Hickson Compact Groups

Eigenthaler, Paul Pontificia Universidad Católica de Chile

Hickson Compact Groups are an ideal laboratory to study ongoing star formation in tidal tails of galaxies since gas from the bright group mem-

ber galaxies is expected to be expelled from the host galaxies in the course of the ongoing interactions forming tidal tails. Once the gas has been expelled, it can cool, self-gravitate and form new stars. Recent independent studies have surveyed interacting galaxies and have found a number of intergalactic HII regions decoupled from their host galaxies. These multiwavelength studies have shown that the large HI clouds outside the investigated galaxies are associated with these actively star forming intergalactic HII regions and suggest that these objects were formed from pre-enriched material, which has been pre-processed within the galaxies and expelled into the intergalactic medium during the galaxy interactions. The frequency in which star formation occurs in the HI clouds is still an open question, requiring deep Hα imaging data. We present preliminary results from deep Hα imaging with the SOAR telescope of 7 Hickson Compact Groups in the Southern Hemisphere to investigate star-forming regions in the tidal tails of these aggregates.

24 Poster

VIPERS: The formation and build-up of the red-sequence over the past 9 Gyr

Fritz, Alexander INAF-IASF Milano

We present results on our analysis of the Luminosity Function (LF) and Colour-Magnitude Relation (CMR) using more than 55,000 galaxies between $0.4 < z < 1.3$ (Fritz et al. 2014, A&A, in press, arXiv:1401.6137) drawn from the ongoing VIMOS Public Extragalactic Redshift Survey (VIPERS) project (Guzzo et al. 2013, arXiv:1303.2623). Using different selection criteria, we define several samples of early-type galaxies and explore their impact on the evolution of the red-sequence (RS) and the effects of dust since $z = 1$. The RS is modelled using stellar population models and the spectral properties suggest a rapid build-up of the RS within a short time scale. We find a rise in the number density of early-type galaxies and a strong evolution in LF and CMR since $z = 1$. Massive galaxies are already in place at $z = 1$ and afterwards experience an efficient quenching of their star formation, followed by a passive evolution with no subsequent mergers. In contrast, low-mass galaxies indicate a different mass assembly history and cause a slow build-up of

the CMR over cosmic time. We discuss possible physical mechanisms that are relevant for the origin and the build-up of the RS by combining multi-wavelength data, spectroscopic properties derived from stacked spectra and morphologies of our galaxies.

25 Poster

Interacting Galaxy Pairs in 3D

Fuentes-Carrera, Isaura — Escuela Superior de Fisica y Matematicas, IPN

Interacting galaxies seem to come in all flavours: breath-taking mergers, spirals with long tails and bridges, beautiful grand-design spirals with small companions, etc. Even galaxies that seem to be isolated reveal on-going interactions with very small satellites. In this work, we will present Fabry-Perot observations of on-going interactions from the spectacular to the very discrete, witnessing such things as induced star-formation, mass-transfer and structure perturbation. We will point out the importance of 3D observations in order to identify interacting systems, to understand the different processes triggered during the encounter, and to constrain numerical simulations of different encounters.

26 Poster

Orientation of galaxies and their clusters as a test of large structure formation

Godłowski, Wlodzimierz — Institut of Physics, Opole University

Problem of large structure formation is one of the most important problems in modern cosmology and extragalactic astronomy. Classical theories (Peebles 1969; Zeldovich 1970, Efstathiou & Silk 1983) were developed and modified by various researchers (e.g. Lee & Penn 2002; Navarro, Abadi & Steinmetz 2004, Codis et al. 2012, Varela et al. 2012). Various scenarios of large scale structure formation make different predictions concerning orientation of galaxies in structures, distribution of

spins of galaxies and alignment between the brightest galaxy and the major axis of the structure. The ultimate test for a given scenario would be to test it against observations. A new method of analyzing galaxy alignments in clusters proposed by Godłowski 2012 now is improved. The distribution of position angles for galaxy major axes was analyzed, as well as the distribution of the two angles describing the spatial orientation of the galaxy plane, both of which provide information about galaxy angular momenta. The aim of the project is to investigate the correlation function of orientation of galaxies in clusters and the orientation of clusters themselves. The implications of the results for theories of galaxy formation are also discussed.

27 Poster

Luminosity function for galaxy clusters

Godłowski, Wlodzimierz Institut of Physics, Opole University

The luminosity function is an important quantity for analysis of large scale structure statistics, interpretation of galaxy counts (Lin & Kirshner 1996). We are trying to construct and study the luminosity function of galaxy clusters. This was performed counting brightness of galaxies belonging to clusters in PF Catalogue in the magnitude range $m_3 + 3$ in PF Catalogue, taking data for galaxies from MRSS. The obtained luminosity function is significantly different than that obtained both for optical and radiogalaxies (Machalski & Godłowski 2000). The implications of this result for theories of galaxy formation are discussed as well.

28 Poster

Radio-optical properties of extragalactic populations in the VIPERS Survey

Gregorini, Loretta Dept. of Physics and Astronomy – University of Bologna

The radio and optical characteristics of faint radio sources and the contribution of the various galaxy populations to the sub-mJy counts are not yet well understood, mainly due to the lack of large data samples. The combination of photometric and spectroscopic data from the VIMOS Public Extragalactic Redshift Survey (VIPERS) with radio data from the VLA FIRST public survey constitutes an unique dataset for such studies. The search of radio counterparts for VIPERS objects allows the investigation of the radio-optical properties of galaxies as a function of redshift and galaxy type. For those galaxies that are not radio-detected, the stacking technique will be applied to push the analysis of radio properties more than one order of magnitude below the FIRST radio flux limit. The availability of spectral type classification and redshifts in VIPERS makes it possible to use the stacking method to determine the average properties of the different classes as a function of redshift. A fundamental requisite for the application of such technique is in fact the availability of a large sample of the target classes, VIPERS being thus an ideal dataset. The average properties of the various galaxy types at very faint flux limits and at different cosmic epochs will thus be investigated and compared with those of the radio-identified galaxies.

29 Poster

Tracing gas through extinction and emission in nearby galaxies

Groves, Brent Max Planck Institute for Astronomy

In the local universe the mass of gas in galaxies is usually measured through the combination of the 21 cm HI line, tracing the atomic gas, and the CO sub-millimeter lines that trace the molecular interstellar medium (ISM). However, dust provides another tracer of the ISM mass, either through extinction or IR emission. Here, using a sample of galaxies from the KINGFISH (IR), HERACLES (CO), and THINGS (HI) sur-

veys, we show the correlation of extinction and individual Herschel bands with the ISM mass. We find the tightest correlation of total gas mass with the longest wavelength data (SPIRE500), but that the molecular gas is more associated with the peak of the IR emission (e.g. PACS160). We provide fits to these relations for use with ongoing surveys with ALMA, and demonstrate how the equivalent widths of the CO lines provide an excellent tracer of the molecular gas fraction in galaxies.

30 Poster

SAMI: A spatially resolved perspective on the role of dust in star formation

Gunawardhana, Madusha — Institute for Computational Cosmology, Durham University

Dust is a fundamental constituent in galaxies, that is both a seed for, and a by-product of, massive star formation. While recent studies based on integrated properties of large samples of galaxies have advanced significantly our understanding of global properties of dust in different galaxy environments across cosmic time, the spatial distribution of dust within galaxies and its link to star formation remains largely a puzzle. I will present the results of a study conducted using spatially resolved spectroscopy of over 440 galaxies, largest sample to date, drawn from the recently started and on-going SAMI (Sydney AAO Multi IFU) survey. Combined with the ancillary information from the multi-wavelength GAMA (Galaxy And Mass Assembly) survey (from Far-UV to Far-IR), this data set provides a unique opportunity to spectrally dissect a large sample of nearby galaxies to explore (i) spatial correlations between individual star forming regions and dust obscuration as traced by Balmer emission lines, (ii) dust obscuration as a function of H-alpha surface density, and (iii) dust obscuration in starburst and quiescent galaxies, split by physical galaxy properties and environments. A large galaxy sample with spatially resolved information spanning a range of environments is the key to solving the puzzle of the relationship between dust and star formation.

31 Poster

CHILI: China Lijiang IFU

Hao, Lei Shanghai Astronomical Observatory

Wide-field IFU technology on medium-size telescope provides a unique science capability that complements larger future facilities. In this presentation, I describe a project, which is already fully funded, to employ a VIRUS-like unit on the 2.4 meter telescope in GaoMeiGu Observatory in LiJiang, China. We name the instrument "CHILI (China Lijiang IFU)". It will be an IFU with the world's largest field of view at $2' \times 4'$. I will discuss the science capabilities of the instrument and how it will complement with ongoing IFU surveys on nearby galaxies, such as the MaNGA and Califa.

32 Poster

The Milky Way's Satellite System in a cosmological Context

Hensler, Gerhard Universität Wien

The evolution of the Milky Way's (MW) satellite galaxies belongs to the most intensely debated but poorly understood astrophysical challenges for various reasons: At first, in CDM cosmology a vast number of subhalos is expected around massive galaxies and should contain gas of which stars formed. This is in contrast with the number of observed satellites around the MW. Secondly, the yet observable accretion of satellites by the MW should have led to the built-up of parts of the Galactic halo with stellar kinematic and chemical abundances witnessing those events. Also these expected signatures are not observed. At least, the correlations of angular momentum vectors and the orbital confinement to a thin disk of satellites around the MW and also Andromeda are increasing demands to our understanding of the co-evolution of a satellite system with its parent galaxy. To solve these numerous and various problems numerical simulations from cosmological to galactic scales and semi-analytical galaxy models have been undertaken which, however, not yet succeeded to converge to a unique and convincing solution. Here we present a comprehensive and self-consistent approach of galaxy evolution to demonstrate the observable issues of a satellite system developed from LCDM simulations.

33 Poster

UGC 10205: Tomography of a Merger

Hernandez, Hector Instituto de Astronomia, UNAM

We present the first results of an analysis of the CALIFA observations for the galaxy UGC 10205. We combine our analysis with deep broad-band and Hα observations from the 2.1m telescope at OAN-San Pedro Martir Observatory, Mexico. Our image analysis provides evidence for large-scale tidal debris in the halo of this galaxy suggestive for a major merger event. From the spectroscopy we also provide evidence for the presence of an AGN in the central region. UGC 10205 is actually a very isolated galaxy from the UNAM-KIAS catalog with any similar-sized neighbors within a 6 Mpc volume.

34 Poster

Gas heating and cooling in the disc of nearby edge-on galaxy NGC 891

Hughes, Thomas Universiteit Gent

We present preliminary results from a study of the heating and cooling of the interstellar gas in the nearby edge-on galaxy, NGC 891, a target of the Very Nearby Galaxies Survey. We probe these processes on sub-kiloparsec scales using emission maps of the [CII] 158 μm, [OI] 63 and 145 μm, [OIII] 88 μm, and [NII] 122 and 205 μm far-infrared (FIR) lines obtained with the Herschel PACS and SPIRE instruments. Combining these data with Spitzer MIPS 24 μm and PACS 70 and 160 μm imaging to trace the total infrared flux (TIR), we measure the photoelectric heating efficiency across the disc via the ([CII]+[OI])/TIR ratio, confirming the previously observed decrease in efficiency with increasing FIR colour. We estimate the intensity of the local far-ultraviolet radiation field, G_0, and the gas density, n_H, by comparing these observations to models of photodissociation regions. These estimates are found to be consistent with the properties of the spiral arm and inter-arm regions of the M51 galaxy.

35 Poster

Metallicity gradients of galaxies in the Herschel Reference Survey

Hughes, Thomas Universiteit Gent

We introduce a pilot project to obtain metallicity gradients for a sample of twenty nearby galaxies drawn from the Herschel Reference Survey. Our sample is representative of normal, star-forming spiral galaxies. We have obtained optical spectroscopic observations using the Very Large Telescope with FORS2 in multi-object mode, targeting individual HII and star-forming regions across the galactic discs. From the ratios of the strong emission lines in the spectra, we estimate the local gas-phase oxygen abundance and construct metallicity gradients. Combining these new data with Herschel PACS/SPIRE far-infrared photometric observations and maps of the 21 cm line emission, to trace the dust content and cold gas respectively, will allow the study of the gas-to-dust ratio as a function of metallicity on sub-kiloparsec scales. Comparing these observations with current chemical evolution models will shed light on the local processes governing the star formation cycle within galaxies.

36 Poster

The Survey of Lines in M 31 (SLIM): Origin of [CII] Emission

Kapala, Maria Max-Planck-Institut für Astronomie

The [CII] 158 micron line is typically the brightest far-IR emission line from star-forming galaxies. To use this line as a tracer of star-formation and a diagnostic of ISM conditions, we must understand which phases of the ISM and what gas heating sources are contributing to it. To address these issues, we have assembled a unique set of observations. As an external massive galaxy, Andromeda is perfect to understand [CII], as we can resolve individual star-forming regions in the galaxy, but it is a representative of more distant galaxies. The observations includes: [CII] 158 micron and [OI] 63 micron lines from Herschel PACS; fully sampled optical integral field spectroscopy from PPAK on the Calar Alto 3.5 m, and Herschel dust continuum mapping from 70-500 microns. These observations span a range of conditions across Andromeda. We present first results on how [CII] correlates with the far-IR continuum on ~ 50 pc scales. In particular, we find that star-forming regions

in M 31 do not exhibit a "[CII] line deficit" even in regions where the dust is very warm. Using the optical line emission, we determine the fraction of [CII] emission spatially associated with star-forming regions. Our method implies a high fraction $\sim 20-90\%$ of [CII] emission is coming from diffuse regions. These diffuse regions appear to dominated by the UV interstellar radiation field, which we infer from the Pan-Chromatic Hubble Andromeda Treasury data to be dominated by B stars. We consider as well photon leakage from the SF regions. We investigate relation between [CII] emission and SFR surface density. On ~ 50 pc scales it is sub-linear in most of the fields, but it approaches 1–1 relation when averged over whole fields (~ 700 pc scales), which is in agreement with other extragalactic studies on similar scales. Our results suggest that studies using [CII] to trace the massive star-formation rate must consider how dominant is the contribution of older stellar populations in heating the ISM gas.

37 Poster

Metal-poor Wolf-Rayet HII galaxies revealed by integral field spectroscopy

Kehrig, Carolina Instituto de Astrofisica de Andalucia

In this contribution, we will present some results from our ongoing programme on IFS of metal-poor Wolf-Rayet (WR) HII galaxies. Our main goal is to use IFS to simultaneously locate and characterize the WR population, and examine the spatial correlation between WR stars and the properties of the surrounding ionized gas in our sample galaxies. Special emphasis will be given to our recently published results on Mrk 178, the closest metal-poor WR HII galaxy. The strength of the broad WR features and its low metallicity make Mrk 178 an intriguing object. The study of the WR content has been extended, for the first time, beyond the brightest star-forming knot of Mrk 178, uncovering new WR star clusters. Systematic aperture effects on the detection of WR features and the origin of high-ionization emission lines (e.g. HeII) will be also discussed. The latter is still an intriguing topic for the field of ionized nebulae, and is key for many prospective studies, such as for the preparation of new missions/instruments (e.g. NGST, JWST), to

guide observers searching distant, primeval objects like PopIII galaxies.

38 Poster

A far-IR and optical 3D view of the starburst driven superwind in NGC 2146

Kreckel, Kathryn Max Planck Institute for Astronomy

Galaxy outflows are a vital mechanism in the regulation of galaxy evolution through feedback and enrichment. NGC 2146, a nearby infrared luminous galaxy (LIRG), presents evidence for outflows along the disk minor axis in all gas phases (ionized, neutral atomic and molecular). We present new far-IR Herschel imaging and spectroscopy of this galaxy from the Key Insights on Nearby Galaxies: a Far-Infrared Survey with Herschel (KINGFISH) project, as well as new optical integral field unit spectroscopy, to map the kinematics and gas excitation in the central 5 kpc and trace the dust distribution. We observe an increased velocity dispersion in the [OI] 62 μm, [OIII] 88 μm, [NII] 122 μm and [CII] 158 μm fine-structure lines that is spatially coincident with shocked gas above and below the disk. Unhampered by extinction, the far-IR lines trace the outflow to the base of the superwind at the disk center, and we discuss the potential for using [CII] as a tracer of outflows such as this in high redshift systems with ALMA. In the stellar kinematics, we observe decoupling from the regular disk rotation seen in all gas phases, which we attribute to a merger that has not produced a fully elliptical morphology. We consider the role of the superwind in the evolution of NGC 2146 and speculate on the evolutionary future of the system.

39 Poster

Is there a dependence in metallicity evolution on galaxy structures?

Kuchner, Ulrike Universität Wien

We investigate the evolution of scaling relations in massive clusters as well as mass growth in bulges and disks over time and environments. For this we exploit the deep high-resolution imaging of the multi-cycle HST Treasury program CLASH (16 bands from UV to NIR with ACS and WFC3), amended by $30' \times 30'$ SUBARU imaging, and accurate spectroscopic information from an extensive VLT VIMOS follow-up. We use MegaMorph, a new wrapper for GALFIT, which uses simultaneous multi-band fitting to ensure reliable bulge-disk decompositions over all CLASH bands. For accurate gas metallicity measurements we apply the method of 5 strong emission lines. Our analysis leads to an extensive investigation of the relationships of resolved stellar structures, sizes, and masses as well as star formation rates and metallicities over a range of environments and cosmic epochs. As an example, here we show the fundamental metallicity relation of galaxies in massive clusters as well as in the field at $z \sim 0.5$. We pay special attention to the morphologies by a quantitative analysis of B/D decomposition. This allows us to follow the metallicity downsizing effect while connecting this to the galaxies' accurate morphologies.

40 Poster

The connection between Initial Mass Function and Black Hole scaling relations

Läsker, Ronald MPIA

We present an investigation of stellar mass ($M_{\rm star}$), Initial Mass Function (IMF), Dark Matter content, and mass ($M_{\rm bh}$) of the central Supermassive Black Hole (SBH) in an unusual compact galaxy, employing Schwarzschild orbit-based dynamical models and stellar population fits constrained by high-resolution imaging and spectroscopic data. We demonstrate that a joint dynamical and population analysis that includes the IMF slope as a parameter can significantly reduce degeneracies between $M_{\rm bh}$ and stellar mass-to-light ratio. Our results confirm that the IMF is non-universal and show that an extremely bottom-heavy

IMF can exist even in galaxies of moderate luminosity and size. However, if a "standard" IMF (Chabrier or Salpeter) is assumed, our kinemtical contraints demand an "über"-massive SBH of $M_{\rm bh} = 10^{10}\,M_{\odot}$ – a clear outlier in the current $M_{\rm bh} - M_{\rm star}$ scaling relation. We finally present a significant re-calibration of $M_{\rm bh} - M_{\rm star}$ based on vastly improved bulge photometry. The results imply that, in order to draw firm theoretical conclusions on the SBH-host galaxy connection, we require more homogenous measurements of $M_{\rm bh}$ for a broader range of SBH host parameters – a task for which ground-based AO-assisted IFU spectroscopy is uniquely suited.

41 Poster

Dual Halos in Massive Early-type Galaxies

Lee, Myung Gyoon Seoul National University

For long it has been considered that early-type galaxies have a single halo. Based on the recent studies of the globular clusters and resolved stars in nearby early-type galaxies, we find that massive early-type galaxies have dual halos; a metal-poor (blue) halo and a metal-rich (red) halo. The red halos are more elongated and more centrally concentrated than the blue halos. It is expected that the red halos may be rotating faster than the blue halos. Previous 3D spectroscopic studies covered only the central regions of the early-type galaxies, providing very useful information of their bulges. However, they could not address the properties of their halos. Future 3D spectroscopic studies need to expand to a wider field to study the halos in massive galaxies. We discuss implications of the dual halos in regard to formation of massive galaxies in the universe.

42 Poster

A radio-optical study of resolved star-formation in galaxies from the SAMI survey

Leslie, Sarah RSAA, Australian National University

Despite many decades of effort, the relation between radio continuum emission and the star-formation rate (SFR) in galaxies is still not well understood. Previous studies have indicated that the tight correlation between radio and far infrared (FIR) flux used to derive local scaling relations between the radio continuum power and SFR breaks down for faint, low metallicity, low mass galaxies. To provide new insights into the physics behind these scaling relations across a range of stellar masses, we will combine resolved radio continuum information with the great quantity of information provided by optical integral field spectroscopy (IFS). We will draw our IFS data from the first massively multiplexed IFS survey, the Sydney-AAO Multi-object Integral-field spectrograph (SAMI) galaxy survey, and our radio data from the Faint Images of the Radio Sky at Twenty centimeters (FIRST) and the NRAO VLA Sky Survey (NVSS) catalogues. In this project we aim to:
— Compare the spatial distribution of star-forming regions as traced by Hα emission with the brightness profile of the radio emission to better understand the radio emission as a SFR tracer within galaxies, and
— Investigate whether the mix of thermal and non-thermal radio emission in star-forming galaxies changes with galaxy stellar mass and metallicity.

43 Poster

Studying the Milky Way via its Extragalactic Analogs

Licquia, Timothy University of Pittsburgh

Determining the global properties of the Milky Way presents unique challenges. Our position within the disk of the Galaxy yields a limited view of its overall light emission. For this reason, measurements of the global properties of the Milky Way, such as its color and luminosity, have proven difficult to date. Here, we capitalize on the SDSS dataset to better determine the Milky Way's luminosity and integrated color. We exploit the inherent dependence of galaxies' photometric properties on

their total stellar mass, M_*, and star formation rate, SFR. We select a sample of Milky Way analog galaxies designed to match the best Galactic M_* and SFR measurements, including measurement uncertainties. By analyzing the properties of these Milky Way analog galaxies, after correcting for inclination effects and Eddington bias, we find that the color of our Galaxy is $g - r = 0.698^{+0.064}_{-0.061}$ mag, with absolute magnitude $M_r = -21.07^{+0.34}_{-0.35}$ mag. Our results place the Milky Way amongst the reddest and most luminous spiral galaxies. Its position in the SDSS $(g-r)/M_r$ color-magnitude diagram lies very close to the saddle point of the bimodal distribution of red and blue galaxies. Additionally, the Milky Way analog galaxies we have identified are suitable for a variety of 3D follow-up studies.

44 Poster

Velocity Field of the Mysterious Optical Emission-Line Nebula in the BCG NGC 1275

Lim, Jeremy University of Hong Kong

Nearly 60 years after its discovery, the nature of the spectacular optical emission-line nebula in NGC 1275, the central giant elliptical galaxy in the Perseus cluster, remains bewildering. Only BCGs in cool-core clusters exhibit luminous nebulae, providing a link to possible X-ray cooling flows. The nebula in NGC 1275 has a complex filamentary structure, and a counterpart in molecular hydrogen gas. The nebular emission lines are probably excited by energetic particles, possibly the surrounding X-ray-emitting gas that penetrates into the nebula. A few locations in this nebula, however, have spectra resembling HII regions; in addition, some of the filaments are closely associated with young star clusters. Here, we present for the first time the velocity field of the entire nebula in NGC 1275 as measured with an integral field spectrograph on the Calar Alto 3.5-m telescope. By contrast with previous findings that at least one filament reverses in radial velocity along its length, supporting the idea that the outer part of this filament is being uplifted and its inner part infalling, we find no filament with such kinematics over the entire nebula. We confirm that a U-shaped filament has kinematics consistent with a vortex generated behind a rising bubble (blown by the

radio jets from the AGN in NGC 1275) and identify a counterpart to this filament, but find no other such filaments throughout the entire nebula. We suggest that at least some of filaments likely trace infall, whereas many others are draped over the surfaces of rising bubbles.

45 Poster

Three-Dimensional Spectroscopy and Star Formation Histories of Field E+A Galaxies

Liu, Charles CUNY College of Staten Island/AMNH

E+A (i.e., post-starburst or 'k+a') galaxies represent some of the best examples of a system whose star formation is on the verge of being quenched. Thus, they can be valuable signposts of an important but poorly understood process of galaxy evolution. We present integral field spectroscopy and radio continuum measurements of E+A galaxies in the field with redshift $0 < z < 0.2$, with the goal of examining the properties of this short-lived evolutionary phase. We focus particularly on J152426.55+080907, also known as 'G515' or 'Flagellan' ($z = 0.088$) for which more than 20 years of spectroscopic data are available. On several-kpc scales, its optical light is dominated by stellar populations varying in age from 0.5 to 1 Gyr. Optical line emission, particularly in [OII], also appears to have been highly variable in both intensity and spatial location over the past two decades. We also see substantial evidence of outflows; and multi-epoch radio observations show weak and significantly variable radio continuum emission, possibly indicative of an AGN near the end of its duty cycle. E+A galaxies apparently do not fade gradually from "star-forming" to "quenched" states, but rather cease their activity unevenly, in fits and starts, within very dynamic environments.

46 Poster

Extinction properties of 8 μm selected sources from the AKARI NEP Deep field

Malek, Katarzyna Nagoya University

We would like to present the properties of the 8 μm selected sources from $z = 0$ to $z = 2$. For our analysis we used data from Infrared AKARI satellite based on the NEP deep field cross-correlated with optical and ultraviolet data. We would like to discus the physical properties such the dust attenuation, the stellar masses and the star formation rate with redshift performed from stack analysis and the SED fitting calculated for more than 3000 sources.

47 Poster

The impact of the orientation on the lobe asymmetry in 3C328 radio galaxy

Marecki, Andrzej Torun Centre for Astronomy

Classic radio galaxies of the so-called Fanaroff-Riley (FR) type II have two lobes terminated with hotspots but 3C328 radio galaxy is somewhat different – while one of its lobes is a typical FR II-like with a hotspot, the other one has no hotspot. It is not of FR I type, though. We carried out the VLBI observations of the core component and we found that it has a jet and a weak counter-jet. The jet points towards the lobe without a hotspot. We suggest the following interpretation of the nature of 3C328. This is just an average FR II radio galaxy but its nucleus remained in an off-state for some time in the recent past and no jets were produced then. As a result, the hotspots were not fuelled and faded out. However, given that one lobe is farther from the observer than the other, the hotspot in the far-side lobe is perceived as not decayed yet due to the light-travel lag. The milliarcsecond structure confirms the above scenario. The jet is always beamed towards the observer so the lobe it points to must be the near-side one. Therefore, this must be the lobe whose hotspot should have vanished, which is exactly what we observe. 3C328 stands as an interesting example of how the orientation of a double-lobed radio source in 3D can modify its apparent shape.

48 Poster

The interaction of the outflow with the molecular disk in the Active Galactic Nucleus of NGC 6951

May, Daniel Universidade de São Paulo

NGC 6951 is classified as a late-type barred spiral galaxy (SAB(rs)bc), 24 Mpc away from us ($1'' = 117$ pc). It is known there is low HI detection, implying in a high content of H in its molecular form, whereas the ionized H, detected by the HST/ACS, has a morphology of a stellar ring with $5''$ of radius and a central elongated structure whose position angle agrees with the radio emission with PA$= 156°$.The observations were made with the Gemini Integral Field Spectrograph NIFS, on K band, and we analyzed archive data from GMOS, in the optical, and from HST filter F814W (Hα + [N II]), focusing on the central region of NGC 6951 within a radius of 50 pc. This allows us to probe the gas both in the molecular and ionized emission lines, which means it is possible to fully describe eventual phenomena of cold gas falling at the nucleus and hot gas being ejected, namely, the AGN inflow and outflow. After a sophisticated image processing, as the removal of high spatial and spectral frequencies, Richardson-Lucy deconvolution and PCA analysis (Steiner et al. 2009), we detected which seems to be an edge-on molecular disk in H_2, rotating with a velocity of ~ 40 km/s and size of $0.4''$ (40 pc), distinct of the inclination inferred for the galaxy disc, with $i = 42°$. Contrary to what was expected, there is no indication that the existing dust is related to the warm H_2. We also found evidence of an outflow in form of an ionization cone in blueshift, highly misaligned with the molecular disk, but coincident with the radio PA. The molecular gas is more turbulent in this region, and we interpret this scenario as a "digging" process induced by the jet through the disk, ejecting some of the molecular gas at the same orientation of the cone.

49 Poster

The Most Massive Galaxies and Black Holes: A View with 3D Spectroscopy

McConnell, Nicholas IfA, University of Hawaii

Feedback from supermassive black holes is crucial for regulating star formation in massive galaxies and galaxy clusters, and yet stars and black holes feed from the same gas reservoirs in young galaxies. Existing scaling relations between galaxies and supermassive black holes give limited insight to the physical processes of galaxy growth, because they rely on globally averaged properties. To address this issue we have combined data from multiple integral-field spectrographs to probe stellar kinematics on scales from $\sim 10\,\mathrm{pc}$ to $\sim 10\,\mathrm{kpc}$ in over two dozen massive early-type galaxies. These data enable simultaneous measurements of black hole masses and three-dimensional stellar structures such as counter-rotating components or inner cores dominated by tangential orbits. Our growing sample of galaxies with 3D stellar data and known black hole masses will prove a powerful tool for understanding the formation and assembly of the most massive galaxies and the beasts at their centers.

50 Poster

Linking star formation and galaxy kinematics in the massive cluster Abell 2163

Menacho, Veronica Universität Wien

The origin of the morphology-density relation is still an open question in galaxy evolution studies. It is most likely driven by the combination of two effects: 1) the efficient star formation in the highest peaks of the mass distribution at high redshift (nature) and 2) the transformation by environmental processes at later times as galaxies fall into more massive halos (nurture). In this poster we show the power of combining high-resolution spectroscopy (VIMOS) data with broad-band photometry (CFHT) and narrow-band imaging (WFI). Our target is the very massive cluster Abell 2163 at $z = 0.2$ which is in process of merging, providing the ideal environment to study different effects. We focus on the galaxy kinematics and derive dynamical masses for those that

show regular rotation curves. Galaxies that show irregular rotation are also analysed to study the origin of their distortion. We compare these results with information with stellar masses and structural parameters from the imaging. From the narrow band photometry, centered on the redshifted Hα line, we derive star formation rates. The combination of these parameters provides a more complete picture of the processes that lead to the quenching of the star formation as galaxies fall into clusters.

51 Poster

A chemo-kinematic survey of $z \sim 1$ star forming galaxies using Keck OSIRIS LGS-AO

Mieda, Etsuko University of Toronto

We present first results from the Intermediate Redshift OSIRIS Chemo-Kinematic Survey (IROCKS) of $z \sim 1$ star forming galaxies. The majority of high redshift galaxy studies using integral field spectrograph and adaptive optics (AO) have focused on $z > 1.3$, where Hα falls in H- and K-band. The selection of these redshifts is dependent on instrumental sensitivity, sky background, and AO performance. Our team has installed a new, more efficient grating in OSIRIS (Mieda et al., 2014), and with the new Keck-I AO system, this has opened up the $z \sim 1$ epoch (where Hα falls in J-band). We selected $z \sim 1$ galaxies from a variety of surveys: Team Keck treasury Redshift Survey in GOODS-N; European Southern Observatory-GOODS spectroscopic program in GOODS-S; DEEP2 fields; and Ultra Deep Survey field. We have targeted Hα and [NII] emission lines in J-band and have spatially resolved the galaxies at sub-kilo parsec scale. The $z \sim 1$ regime is a critical epoch to understand galaxy evolution; it is when the star formation rate density starts to rapidly drop (Hopkins 2006), and the stellar mass density begins to be more established to present-day values (e.g. Ilbert et al., 2013). We have combined our sample with deep HST continuum images, and are able to reveal the dynamics, morphologies, metallicity distribution, emission-line diagnostics, and star formation rates of galaxies spanning this crucial $z \sim 1$ epoch.

52 Poster

Dynamics and ISM properties of the MHONGOOSE-WiFeS Galaxies

Mogotsi, Moses Astronomy Department, University of Cape Town

MHONGOOSE (PI: E. de Blok) is a 3000 hr survey planned on the MeerKAT radio telescope which is currently being built is South Africa. The aim of the survey is to study the connection between star formation, HI, dynamics and accretion by targeted deep HI observations of 30 nearby galaxies. The final sample of galaxies will be taken from the SINGG-SUNGG survey (Meurer et al. 2006, Wong 2007). We are performing spectroscopic observations (MHONGOOSE-WiFeS) of the precursor sample (96 galaxies) in order to allow us to better select the final sample and to provide ancillary data for the survey. We are using the WiFeS integral field spectrograph. In our observations we are studying the dynamics of the precursor sample, the ISM, metallicity distributions and looking for outflows and inflows. We will present these observations and our studies of the metallicity distribution, ISM and dynamics of the galaxies observed from the precursor sample.

53 Poster

The Wolf-Rayet star population and its surrounding gas in nearby starbursts

Monreal Ibero, Ana Observatoire de Paris – GEPI

The interaction between massive star formation and gas is key in galaxy evolution. Given the level of detail that one can achieve in very nearby starbursts, these constitute ideal laboratories to learn about those processes acting in this interaction. Specifically, among many others, one aspect that deserves attention is the content of Wolf-Rayet stars (i.e. number, type and distribution) and how this relates with the characteristics of both the surrounding gas and the stellar population in general. In this contribution I would like to present results on two nearby ($D < 4$ Mpc) starbursts, where we are currently studying their Wolf-Rayet content and how this relates with the physical and chemical properties of the surrounding ionized gas by means of Integral Field Spectroscopy data.

54 Poster

Gas accretion history of galaxies at $z \sim 0-2$: comparison of observational data of molecular gas with a mass evolution model of galaxies

Morokuma-Matsui, Kana — Nobeyama Radio Observatory, National Astronomical Observatory of Japan

We present a result of CO(J=1-0) observations toward disk galaxies at intermediate redshifts and a mass evolution model which can reproduce the panchromatic observational data including molecular gas fraction. CO(J=1-0) observations have been conducted towards disk galaxies with stellar mass of $\log(M_o/M_\odot) \sim 10.4-11.3$ at $z \sim 0.1-0.23$ since Dec. 2012 with the 45-m telescope at Nobeyama Radio Observatory. Twelve galaxies have been observed so far (as of 31st Jan. 2014, the observation continues until May this year) and the breakdown is as follows; significant detections from the seven, tentative detections from the two, and non-detection from the three among the sample. Combining our CO data with literature-based data of galaxies at $z \sim 0-2$, we estimated the molecular gas fraction as a function of redshift and stellar mass. With this new observational constraint, optical-NIR colors and sSFR, we constructed a mass evolution model of galaxies including both stars and gas. We investigate the gas accretion history of galaxies with different stellar masses with this model and discuss possible main mechanisms for the variety of today's galaxies.

55 Poster

The cosmic skidmark: IFU spectroscopy of a transforming galaxy undergoing ram-pressure stripping

Murphy, David — Pontificia Universidad Catolica de Chile

We present the case of "the cosmic skidmark" – a $z = 0.18$ galaxy undergoing accretion onto a galaxy group. This galaxy is currently undergoing a transformation from the blue cloud onto the red sequence, shows evidence of a pronounced 50 kpc cometary tail indicative of ram-pressure stripping, and has clear signatures of star formation. We use deep optical imaging and VIMOS Integral Field Unit (IFU) spectroscopy to investigate the star formation within this evolving galaxy and probe the underlying mechanisms driving this transformation.

56 Poster

High-resolution 3D dust radiative transfer with DART-Ray

Natale, Giovanni University of Central Lancashire

We present the results of a 26 pc resolution dust radiative transfer (RT) calculation on a N-body/SPH simulation of a galaxy with parameters similar to the Milky Way. The RT calculation has been performed using DART-Ray, a pure ray-tracing radiative transfer code able to handle arbitrary 3D distributions of stars and dust as well as anisotropic scattering. For a set of view-angles, we produced dust-attenuated stellar maps in the optical/UV as well as dust emission maps in the MIR/FIR. Dust emission calculations include the full-treatment of grain stocastical heating. In this talk, we discuss the predicted observed properties of the simulated galaxy in comparison to its intrinsic characteristics on global and local scales.

57 Poster

Cosmic ray driven dynamo in barred galaxies – 3D numerical simulations.

Nowak, Natalia Astronomical Observatory, Jagiellonian University

We present three-dimensional global numerical simulations of the cosmic ray driven dynamo in barred galaxies. The radio observations show the presence of the ordered magnetic fields around several mG. We study the evolution of the interstellar medium of the barred galaxy in the presence of non-axisymmetric components of the gravitational potential, i.e. the bar. The three main components of the interstellar medium, i.e. magnetic fields, gas and cosmic rays are dynamically coupled. The magnetohydrodynamical dynamo is driven by cosmic rays, which are continuously supplied to the disk by supernova (SN) remnants. Additionally each SN explosion is a localized source of magnetic vector potentials. In all models we assume that 10% of 10^{51} erg of SN kinetic energy output is converted into CR energy, while the thermal energy from SNe explosions is neglected. The simulations are performed with the GODUNOV code. To compare our results directly with the observed properties of galaxies we construct realistic maps of high-

frequency (Faraday rotation free) polarized radio emission on the basis of the simulated magnetic fields. We found that cosmic-ray driven dynamo in barred galaxies amplify magnetic fields efficiently. The fastest rate of magnetic field growing is 195 yr for SN frequency $1/50\ \mathrm{yr}^{-1}$. The intensity of obtained magnetic field is similar to observations (80 mG in central part of barred galaxy and few mG in spiral arms). The polarization and rotation measure maps showed that they are also similar to observations. We also found the effect of shifting of magnetic arms working in 4 models (from the sample of 5).

58 Poster

Detailed stellar and gaseous kinematics of M 31

Opitsch, Michael Max Planck Institute for Extraterrestrial Physics

We present kinematical maps of M 31 obtained with the optical IFU spectrograph VIRUS-W, which has a spectral resolution of 9000, corresponding to an instrumental velocity dispersion of 15 km/s. This allows us to investigate the motions of the stars and the gas in M 31 in unprecedented detail. Our observations cover the inner region of M 31 completely out to about $10'$ along the major axis and $3'$ along the minor axis and sample the disk along six directions, reaching $11'$ for the minor axis and $24'$ for the major axis, which is approximately one disk scalelength. We fit the line-of-sight velocity distribution for the stellar continuum and the [OIII] and [NI] gas emission lines. In the resulting kinematical maps, the stellar velocity field shows an asymmetry along the minor axis, pointing to triaxiality of the bulge and/or the existence of a stellar bar. The gas velocity field reproduces at large scales the features of the atomic hydrogen, but regions with interesting double-peaked velocities are also detected, suggesting the presence of two kinematically distinct gas components. The second of these components usually has significantly lower absolute velocities than the first, sometimes by as much as 150 km/s.

59 Poster

Molecular Gas in LARS – a Local Sample of Star Forming Galaxies as a High-z Proxy

Puschnig, Johannes Stockholm University

Lyman Alpha emission plays a crucial role for observations of the high-redshift Universe since recombination nebulae reprocess approximately 1/3 of the raw ionizing power into a single emission line. Therefore, many thousands of high-z galaxies were observed and studied using the Lyman Alpha line to date. However, its interpretation is complex, because of resonant scattering of Lyman photons. The only way to remedy this complicated situation is to study the Lyman Alpha emission on a spatially resolved basis in a local sample of galaxies such as our Lyman Alpha Reference Sample (LARS; Hayes et al., 2013, 2014). Beside the importance of Lyman Alpha analysis for gaining insight into the early Universe, also Carbon Monoxide (CO) transitions are increasingly observed at higher redshifts. Although sample sizes still remain small, CO observations are most important for studying the evolution in the star formation efficiency (SFE). Recent studies find evidence for an increase in SFE with redshift, but caution that the results are most sensitive to the applied conversion factor. However, there seems to be consensus that gas-rich mergers show an enhancement in their SFE. Here, we present our recently executed CO J=1-0 observations of LARS galaxies carried out with the 45 m telescope at the Nobeyama Radio Observatory. Our observations suggest that the SFE is dramatically increased in our sample, which confirms the suitability of LARS as a proxy for high-redshift galaxies. We interpret the enhanced SFE as a result of shock-heating of the ISM introduced by tidal forces. Subsequently, higher external pressure acts onto the molecular clouds and supports their collapse. This scenario is supported by the presence of tidal features as well as the presence of compact and dense star clusters visible in our HST images.

60 Poster

Stellar Mass Maps for S4G

Querejeta, Miguel Max Planck Institute for Astronomy

To identify the drivers of galaxy secular evolution, stellar mass maps are key to understand gravitational potentials, providing insight into, e.g. the effect of bars, radial stellar migration and cold gas organization. However, mapping the stellar mass distribution is difficult, and so far only small (less than $\sim$ 100 galaxies) stellar mass map catalogs are available. The Spitzer Survey of Stellar Structure in Galaxies (S4G) provides deep imaging for 2352 nearby ($D < 40$ Mpc) galaxies at 3.6 and 4.5 μm, where old stellar populations dominate the emission. But the additional presence of non-stellar emission from PAH and hot dust biases our view of the baryonic mass distribution. Therefore, we constructed a pipeline that uses Independent Component Analysis (ICA) to correct for this non-stellar emission, deriving high-fidelity stellar mass maps for 1500 galaxies; these will be made public through IRSA. We find that as much as $10-30$% of the total light at 3.6 μm typically originates from non-stellar sources, and this fraction correlates very well with SSFR, confirming that this dust emission is related to star formation. To convert the remaining light from old stars into stellar mass, we have calibrated the M/L ratio at 3.6 μm, showing that a single value is a sufficient prescription.

61 Poster

Molecular Gas in the Nucleus of M 51: evidence for AGN feedback?

Querejeta, Miguel Max Planck Institute for Astronomy

AGN feedback is often invoked as a mechanism that regulates star formation and contributes to explain the properties of galaxies observed at different redshifts, but it is still poorly understood. Previous studies of the AGN of the nearby galaxy M 51 (radio jet, Seyfert 2 nucleus) suggested that molecular gas in the central 100 pc ($\sim 2.5''$) is entrained in the radio jet. If true, this would have important consequences for cosmological models where radio-mode AGN feedback has been invoked to shut-down star formation. Our new imaging of HCN, HCO^+ and HNC from the IRAM interferometer and 30 m telescopes reveals abun-

dant HCN/HCO^+ emission from the jet and central kpc disk. Comparison to CO(1-0) kinematics from the PAWS survey shows intriguing evidence of a molecular outflow in the dense gas. Initial analysis of the molecular line ratios suggests a clear effect of the AGN on the dense gas, suggesting that the gas excitation mechanism is photo-dominated. We plan to verify this scenario using optical IFU data available for the center of M51. This will be the first detailed study of how a radio-jet interacts with the surrounding molecular material in the central few kpc of a disk galaxy.

62 Poster

AGN Detections from a complete sample of massive galaxies from the local universe.

Ricci, Tiago IAG - University of São Paulo

Active galactic nuclei (AGN) are objects associated with the capture of matter by a supermassive blackhole. Low luminosity AGNs, namely LINERs and Seyferts, are found in almost 50% of nearby early-type galaxies (Ho, 2008). I will present the first results related to AGN detections from a complete sample of massive galaxies in the southern hemisphere, observed with the GMOS-IFU installed at the Gemini South Telescope. This sample, composed by 35 galaxies, is limited in magnitude ($B < 12.0$) and all objects have $\sigma > 200$km/s. The use of a statistically complete sample allows one to reach robust conclusions about the properties of AGNs in massive galaxies from the local universe. These first results were obtained with PCA Tomography applied to the data cubes of the sample galaxies. This technique was previously applied to a sample of 10 early-type galaxies also observed with GMOS-IFU and the rate of AGN detections in this sample using only PCA Tomography was 80% (Ricci et al, 2014). In the future, we will use these results from PCA Tomography together with standard spectral techniques to obtain important informations about AGNs and their influence in the circumnuclear region of massive galaxies from the local universe.

63 Poster

Near-IR Integral Field Spectroscopy of the central region of NGC5929

Riffel, Rogemar A. Universidade Federal de Santa Maria

We present two-dimensional (2D) near-infrared spectra of the inner $3'' \times 3''$ of the Seyfert 2 galaxy NGC 5929 at a spatial resolution of $\sim$ 20 pc obtained with the Gemini Near infrared Integral Field Spectrograph. We present 2D maps for the emission line flux distributions and kinematics and report the discovery of a linear structure $\sim$ 300 pc in extent and of $\sim$ 50 pc in width oriented perpendicular to the radio jet, showing broadened emission-line profiles. While over most of the field the emission-line profiles have full-widths-at-half-maximum (FWHM) of $\sim$ 210 km/s, at the linear structure perpendicular do the radio jet the emission-line FWHMs are twice this value, and are due to two velocity components, one blueshifted and the other redshifted relative to the systemic velocity. We attribute these velocities to an outflow from the nucleus which is launched perpendicular to the radio jet. This means that: (1) both ionizing radiation and relativistic particles are escaping through holes in the torus perpendicular to the radio jet; and/or (2) the torus is also outflowing, as proposed by recent models of tori as winds from the outer parts of an accretion flow; or (3) the torus is absent in NGC 5929. At other locations the gas kinematics is dominated by rotation in a disk, although some evidences of interaction of the radio jet with the emitting gas are seen as a broadening of the line profiles at the locations of the radio structures.

64 Poster

Spiral Galaxy Evolution as Seen with SpIOMM

Rousseau-Nepton, Laurie Astrophysics research group of Laval University

With SpIOMM, the Imaging Fourier transform spectrometer of the Observatoire du Mont-Mégantic, we obtained simultaneously thousands of spectra over the whole surface of 7 nearby spiral galaxies. These data are ideal to study the emission lines in the visible from the bright HII regions. Our sample of galaxies contains different morphology types, from Sb to Sd, and includes barred and non barred spirals. For these

objects, we measured the size and luminosity of the ionized regions, as well as the gas metallicity and density. Among others, we looked for gradients along the galaxy radius and searched for relations with the galaxy structures (bulge, arms and bar) and with the galaxy morphology. These first results represent important clues in a project aiming at a detailed study of stellar populations that will be used to rebuild the history of spiral galaxies and to identify the relative importance and efficiency of the different mechanisms responsible for their evolution.

65 Poster

The relation between atomic gas and star formation in faint irregular galaxies

Roychowdhury, Sambit — Max Planck Institute for Astrophysics

The empirical relation between (surface) densities of gas and star formation, the Kennicutt-Schmidt law, has been well established for normal star forming galaxies. Recent observational results suggest that the true underlying correlation is between the molecular phase of hydrogen and star formation. But what happens in galaxies which are HI dominated like dwarf irregulars is neither theoretically nor observationally well studied. Primarily using the largest interferometric survey of HI in faint star forming dwarf galaxies in the Local Volume, we show that a near linear correlation exist between the galaxy-averaged surface densities of atomic hydrogen and star formation. But the efficiency of converting gas into stars in dwarf galaxies is an order of magnitude lower than that in spirals. We discuss other issues related to the stochasticity of star formation and sampling of the IMF at low SFRs, like which tracer of star formation should be favoured in this regime, and what fraction of HI at a particular column density should be expected to be hosting ongoing star formation. Finally we discuss what light recent theoretical modelling of star formation in the HI dominated regime can throw on our results.

66 Poster

An Infrared Luminous Merger with Two Bipolar Molecular Outflows: ALMA View of NGC 3256

Sakamoto, Kazushi ASIAA

Mergers of disk galaxies tend to drive gas in the progenitor galaxies to their centers and thereby trigger intense star formation and/or nuclear activities there. The resulting high luminosity nuclei often have gaseous outflows, usually (but not necessarily always) perpendicular to the remnant disks. The already complex 3D structures of mergers are further complicated with this out-of-plane gas distribution and motion. It therefore needs high-quality data to recognize and characterize a luminous merger with its outflow(s). I report in this contribution our recent ALMA observations of an infrared luminous merger NGC 3256, the most luminous galaxy within $z = 0.01$. We resolved its previously-known high-velocity CO emission into two bipolar molecular outflows from the two merger nuclei. One is a starburst-driven molecular superwind with a wide opening angle, the other is a well collimated bipolar molecular jet plausibly driven by an AGN radio jet. Spatially-resolved studies like this are needed to accurately characterize the feedback processes in mergers in their earlier phases of evolution before coalescence of the nuclei.

67 Poster

3D stellar populations properties of nearby disk galaxies with CALIFA

Sanchez-Blazquez, Patricia Universidad Autonoma de Madrid

We present here a study of the stellar metallicity and age distributions in a sample of 62 face-on, spiral galaxies using data from the CALIFA survey. The general properties of the stellar population gradients in the different components of the galaxies and their correlations with other general properties are presented. We also show the possible influence of bars in the properties and distribution of the stars in both, the disk and the bulge region. We will discuss the results in the context of possible mechanism for the formation of disk galaxies. We will also discuss the presence and possible mechanisms of radial migration.

68 Poster

Resolving the role of galaxy mass and environment in star formation with SAMI

Schaefer, Adam University of Sydney, School of Physics

The role of the local environment in the formation and evolution of galaxies is not well understood. While previous surveys (e.g. Lewis et al., 2002, Patel et al., 2009, von der Linden et al., 2010, Wijesinghe et al., 2012) agree on a decline in the global star formation rate within galaxies at higher environment densities, the quenching timescales and mechanisms that affect this relationship remain elusive. Some have argued that this trend is driven by the changing fraction of star forming galaxies in high density environments, while others claim the overall level of star formation in star forming galaxies is reduced. We use extinction corrected Hα measurements from the Sydney-AAO Multi-object Integral Field Spectrograph (SAMI) to quantify the spatial distribution of star formation in $\sim$ 300 galaxies. This sample covers three orders of magnitude in both mass and environment and is the largest of such samples that has been made to date. For each galaxy, drawn primarily from the GAMA survey regions, we compute the total integrated star formation rate and the radial star formation profile for each galaxy from the Hα luminosity.Our data suggest that both the star forming fraction and the star formation rate in star forming galaxies declines in higher density environments. We see evidence for a change in the star formation gradient in low stellar mass galaxies in higher density environments. We conclude that ram pressure stripping of gas in galaxy discs is responsible for quenching star formation in low stellar mass systems.

69 Poster

Spatially and temporally resolved stellar populations with SAMI

Scott, Nicholas University of Sydney

While ΛCDM describes the hierarchical assembly of the dark-matter backbone of galaxies, it is less informative about the stellar component of galaxies. In particular, whether stars are predominantly formed in-situ, or accreted from lower-mass galaxies is an area of much uncertainty. I will present two complementary approaches to addressing

this question using spatially resolved integral field spectroscopy from the SAMI survey. IFS observations allow us to map stellar population properties across a galaxy, using radial trends to discriminate between inside-out and outside-in formation processes. In addition, the SAMI IFUs can be treated as single apertures containing high S/N spectra with well understood aperture affects. Such spectra can be used to determine resolved star formation histories, which can be correlated with kinematic signatures of assembly to determine formation histories for a large sample of galaxies.

70 Poster

Environmental dependence of galaxy formation explored by NIR spectroscopy of two proto-clusters at $z > 2$

Shimakawa, Rhythm Subaru telescope

Proto-clusters are the sites where the progenitors of present-day early-type galaxies are in their formation phase. We have conducted near-infrared spectroscopy of Hα emitters (HAEs) associated to two proto-clusters (PKS 1138 at $z = 2.2$ and USS 1558 at $z = 2.5$) with MOIRCS/Subaru. We have confirmed new membership of 27 and 36 HAEs for respective proto-clusters. The inferred masses of the main-bodies of the proto-clusters are consistent with being typical progenitors of the present-day most massive clusters. Also, the HAEs show much higher [OIII]/Hα ratios which is attributed to their high sSFRs and low gaseous metallicities. Furthermore, we have studied the environmental dependence of the star-forming activities of the HAEs by comparing with those in the field at the similar redshift. The dust attenuation and sSFRs of the HAEs in the proto-clusters are on average higher than those of the field galaxies.This indicates that the mode of star-formation in dense environment may be different from that in the field in the sense that star-formation tends to occur more intensely and in compact dusty regions. Such differences may be caused by external effects of surrounding environments such as galaxy-galaxy interactions.

71 Poster

3D Mapping of Low-z Galaxies on Top of Quasars in the Sloan Digital Sky Survey

Straka, Lorrie University of Chicago

Absorption lines from galaxies at intervening redshifts in quasar spectra are sensitive probes of metals and gas that are otherwise invisible due to distance or low surface brightness. However, in order to determine the environments that these absorption lines arise in, we must detect these galaxies in emission as well. Galaxies on top of quasars (GOTOQs) are low-z galaxies found intervening with background quasars in the Sloan Digital Sky Survey (SDSS) via their narrow galactic emission lines present in quasar spectra. These galaxies can also exhibit strong Ca II and Na I absorption features, providing a sample of GOTOQs with both emission and absorption, a key step in understanding the nature of quasar absorption line systems (QSOALS) at all redshifts. The use of integral field spectroscopy has allowed a higher detection rate of high-z quasar absorber host galaxies than ever before. We now turn this powerful technique to our low-z sample, using the optical Goddard Integral Field Spectrograph at Apache Point Observatory to aid us in understanding the kinematics and gas distribution in these galaxies.

72 Poster

A strong clustering of FIR-selected galaxies in the AKARI All-Sky Survey

Suzuki, Tomoko The Graduate University for Advanced Studies

Various previous galaxy surveys have revealed that different types of galaxies show different spatial distributions. By comparing properties of their spatial distributions or clustering strengths, we can investigate the relationship between the environments where galaxies reside and the properties of galaxies. This provides us vital information on when, where, and how galaxies are formed. In our study, we focus on FIR-selected galaxies from AKARI All-Sky Survey data, which are considered to be dusty star-forming galaxies. We derive their three-dimensional power spectra to explore the statistical properties of their spatial distri-

butions. Our final result is well approximated by a single power-law and similar to the one obtained from the previous study using IRAS PSCz data. Moreover, we also compare our result with the previous studies which use different samples of galaxies selected at other wavelengths, such as optical and UV. We find that our FIR-selected samples are more strongly clustered than the UV-selected galaxies, which are also actively star forming galaxies but tend to be younger than the dusty star forming galaxies. This result may be reflecting the spatial propagation of star forming activities from dense regions to less dense outer regions, or it may be due to some external environmental effects which induce dusty star formation in dense environments. Resolving the internal structures of the FIR-selected galaxies with AO imaging and/or IFU spectroscopy will tell us why they are strongly clustering and what their physical origins are.

73 Poster

Giant Hydrogen Streams and Data Visualisation with the Arecibo Galaxy Environment Survey

Taylor, Rhys Astronomical Institute of the Czech Academy of Sciences

I will present results from the neutral hydrogen Arecibo Galaxy Environment Survey, AGES. This extragalactic survey is observing 200 square degrees of the sky in 16 selected regions covering the full range of galaxy environments, from the Local Void to rich clusters. AGES is sensitive over the redshift range $-2,000 < cz < 20,000\,\mathrm{km/s}$ ($< 45,000\,\mathrm{km/s}$ in some fields where new instrumentation has become available). I will concentrate on results from the background volume behind the NGC 7448 galaxy group, where we have uncovered a number of giant HI streams, some up to 800 kpc in projected length. I will also describe a new visualisation tool we have developed which enables us to view the FITS data cubes in 3D, and also allows us to easily catalogue, mask,and analyse our detected sources. These features have improved our source extraction speed by approximately a factor of 50, transforming a process that could ordinarily take weeks into something that can be done within a day, with no loss of completeness or reliability.

74 Poster

Discovering the Dark Side of Centaurus A's Globular Cluster System

Taylor, Matthew Pontificia Universidad Católica de Chile

A study of the dynamical properties of 125 compact stellar systems around the nearby giant elliptical galaxy NGC5128, based on high resolution spectra ($R \approx 26\,000$) obtained with VLT/FLAMES, is presented. Radial velocity (v_r) and line-of-sight velocity dispersion ($\sigma_{\rm los}$) measurements are performed with the penalized pixel fitting (ppxf) technique. The $\sigma_{\rm los}$ estimates are corrected to the 2D projected half-light radii, $\sigma_{1/2}$, as well as the cluster cores, σ_0, accounting for observational/aperture effects and are combined with structural parameters in order to derive dynamical "half-mass" estimates ($M_{1/2}$) and total dynamical masses ($M_{\rm dyn}$) for 116 members of NGC 5128's star cluster system. In total, 93 NGC 5128 compact stellar systems have dynamical masses measured for the first time along with the corresponding dynamical mass-to-light ratios, $\Upsilon_{\rm dyn}$. We find two distinct sequences in the $\Upsilon_{\rm dyn} - M_{\rm dyn}$ plane, which are well fit by power laws of the forms $\Upsilon_{\rm dyn} \propto M^{0.33\pm0.04}$ and $\Upsilon_{\rm dyn} \propto M^{0.91\pm0.04}$. The shallower sequence simply corresponds to the very bright tail of the globular cluster luminosity function (GCLF), with indications for angular momentum content that increases with dynamical mass. The steeper relation, on the other hand, appears to be populated by a distinct group of objects with potentially significant non-baryonic mass components. This would suggest that the formation and evolution of these compact stellar systems is markedly different from the "classical" globular clusters in NGC 5128 despite the fact that these clusters have luminosities similar to the GCLF turnover magnitude. Lastly, we find three objects that show evidence of being, young, massive, open star cluster candidates, consistent with being formed in the last merging event of its host galaxy.

75 Poster

The SN-Ib factory NGC 2770 spatially resolved

Thöne, Christina IAA - CSIC

NGC 2770 hosted 3 Type Ib SNe between 1999 and 2008. The last of those three, 2008D, was the first SN to have a shock-breakout observed in X-rays, thus marking the exact explosion time of the SN. We obtained VIMOS-IFU data at four positions in the galaxy, including the 3 SN sites, as well as narrow-band tunable filters from GTC/OSIRIS of NII, Hα and SII of the entire galaxy. These data allow us to make maps of metallicity, shocked regions, stellar population ages and more of the entire galaxy. All three SNe lie in the outer spiral arms of the galaxy and lie at the edge or outside the major star-forming regions. Their metallicities are all around half solar and their ages (directly related to their progenitor mass) higher than necessary for single massive progenitors. This could imply that the progenitors had to be binary systems, in line with some previous studies on SN Ib regions. It is also interesting to note that none of the three SNe lie in regions with enhanced SF, low metallicity or age but two of them next to some more extreme regions. Those strong local variations throughout the galaxy make it clear that we need resolved information to determine the properties of different SN progenitors, in particular when they occur in large galaxies like NGC 2770.

76 Poster

Radio Recombination Line studies on M 81/M 82 from LOFAR observations

Toribio, M. Carmen ASTRON

We will present the results of LOw Frequency ARray (LOFAR) observations on M 81/M 82 field using both the Low and High Band Antennae. The goal of these observations is to look for Radio Recombination Lines (RRL) both in absorption and in emission that could provide us with information on the cold gas component in these galaxies.

77 Poster

An 3D analysis of the metal distribution in the merging compact group of galaxies HCG 31

Torres-Flores, Sergio Universidad de La Serena

We present new Gemini Integral Field Unit spectroscopic observations of the central region of the merging system HCG 31, which corresponds to a compact group of galaxies. Using empirical calibrators we have estimated the oxygen abundances of this merger. Despite the advanced merger stage of this system, which is dominated by two main burst of star formation (HCG 31A and HCG 31C), we found an inhomogeneous metal distribution in a scale of 700 parsecs. The member HCG 31C has an oxygen abundance of $12 + \log(\mathrm{O/H}) \sim 8.30$, while member HCG 31A displays an abundance of $12 + \log(\mathrm{O/H}) \sim 8.60$. This fact shows that each star forming complex keeps its metal abundance despite the strong gravitational interaction that this system suffered, suggesting that the mixture of metals in merging galaxies is not an "instantaneous" process.

78 Poster

OSIRIS LGS-AO and PdBI observations of two intriguing $z \sim 1.4$ star forming galaxies

White, Heidi University of Toronto

We present the unique coupling of integral-field spectroscopy (IFS) with adaptive optics (AO) and CO(2-1) observations of two $z \sim 1.4$ star forming galaxies. We discuss the results of Keck OSIRIS LGS-AO observations of two massive ($\sim 10^{10}\,M_{\odot}$ and $\sim 75 - 100\,M_{\odot}$/year) galaxies selected from the DEEP2 survey and investigate the resolved kinematics and nebular line ratios of $H\alpha$ and [NII]. The high spatial resolution granted by AO has allowed for the detection of a weak AGN signature in a $z = 1.36$ galaxy and strong evidence indicative of shocks in a galaxy at $z = 1.39$. Plateau de Bure Interferometer (PdBI) observations for each of these targets have resulted in $> 5\sigma$ detections of CO(2-1) and we report estimates for CO line luminosities and corresponding upper limit estimates for molecular gas masses. For the $z = 1.39$ galaxy, the CO emission is well-correlated spatially to Hα, and thus, we discuss impli-

cations for its gas mass fraction and star formation efficiency. Interestingly, we observe large kinematic offsets between the CO(2-1) and Hα lines in $z = 1.39$ and spatial offsets for the galaxy at $z = 1.36$. For our $z = 1.36$ target, the detected molecular line emission is so significantly offset ($\sim 4''$) from the target's observed NIR/optical emission and continuum that we conclude that it is instead associated with a nearby, secondary DEEP2 source. Finally, we present catalog evidence for an enhanced number of galaxies within one arcminute from the galaxy at $z = 1.36$ that is suggestive of a potential cluster.

79 Poster

3D Study Of Magnetic Fields In NGC 6946 Using Wide-band Polarization

Williams, Anna University of Wisconsin-Madison

Recent advancements in both radio observatories and computing have opened a new regime of 3D observations. Not only do these instruments measure emission lines and radio continuum over much larger bandpasses, but they also simultaneously observe polarized emission over the same large bandpasses with increased sensitivity. This "polarization spectrum" can be used to recover information about the 3D structure of magnetic fields in the universe. Our combined $3 - 20$ cm observations of NGC 6946 taken with the Westerbork Synthesis Radio Telescope provide highly sensitive diagnostics of the internal depolarization across the galaxy. We use model fitting to determine likely mechanisms for depolarization in different regions of the galaxy, and glean information about the coherent and turbulent magnetic fields in NGC 6946. We compare these mechanisms with WNM and CNM properties from HI observations to better understand how magnetic fields affect the turbulent ISM and star formation. We present Faraday dispersion maps that illustrate how we can probe different depths into the galaxy at different wavelengths and display new features of the line of sight magnetic field. This work is just a sample of the new 3D studies that are possible with upgraded and new radio instruments like the VLA, ATCA, and SKA.

80 Poster

A 3D Search for the Interplay between AGN and Star Formation in Galaxies

Wolf, Marsha University of Wisconsin

Integral field optical spectroscopy, near infrared imaging, and radio interferometry are a very powerful combination of tools for studying the interplay between AGN and star formation in galaxies. We introduce a sample of SDSS galaxies with selection criteria designed to maximize our chances of catching both processes in action. The galaxies are post-starburst, are allowed, but not required, to have ongoing star formation, and potentially contain radio AGN. The resulting sample includes not only objects classified as traditional post-starbursts, but also ones that would have been classified as Seyferts based on their emission line properties alone. The systems span a range of merger phases from initial interaction to fully merged, providing snapshots throughout the entire sequence. We are compiling a multi-wavelength data set, including spatially resolved optical spectra using IFUs on WIYN, near infrared images using WHIRC on WIYN, and continuum radio maps from the VLA and GMRT. Here we present initial results highlighting the power of 3D observations. A prime example is J0754+1648, an interacting system in which we see a post-starburst region near a radio AGN, surrounded by highly ionized gas and signs of an outflow, which is strongly suggestive of star formation truncation by AGN feedback.

81 Poster

Star Formation and Gas Accretion in Nearby Galaxies

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It has been suggested that gas accretion in galaxies enhances star formation. In order to quantify the relationship between gas accretion and star formation, we analyze a sample of nearby galaxies from the WHISP survey which contains galaxies with and without evidence for recent gas accretion. We compare combined radial profiles of FUV (GALEX) and IR 24 μm (Spitzer) characterizing distributions of recent star formation with radial profiles of CO (IRAM, BIMA, or CARMA) and HI (WSRT) tracing molecular and atomic gas contents to examine star formation

efficiencies in symmetric (quiescent), asymmetric (accreting), and interacting (tidally disturbed) galaxies. In addition, we investigate the relationship between star formation rate estimated by FUV and HI in the outer disks for the three groups of galaxies.

82 Poster

Strong ram-pressure stripping and widespread star formation in the high velocity system towards the center of the Perseus cluster

Yu, Pui Ling The University of Hong Kong

The presence of a foreground infalling (at $\sim$ 3000 km/s) galaxy, known as the high velocity system (HVS), towards NGC 1275, the central giant elliptical galaxy in the Perseus cluster, complicates our understanding of star formation in the latter galaxy possibly fueled by cooling of the hot intracluster medium (ICM). To study the nature of HVS and separate the young star clusters associated with this galaxy from NGC 1275, we have mapped the gas kinematics in HVS. We confirm that HVS is a rotating disk galaxy, and detect for the first time a gas component that is systematically blueshifted by $\sim$ 200 km/s but shares the same global distribution and velocity gradient as the main body of gas. The latter component represents gas stripped from HVS by ram pressure from the ICM. We show that there is an excellent spatial correspondence between a number of the young star clusters seen towards the inner regions of NGC 1275 and bright Hα emission from HVS. The [NII]/Hα ratio of HVS indicates that this galaxy has a relatively low metallicity, and hence that ram pressure has strongly enhanced the rate of star formation in this galaxy to its present value of $\sim$ 2 solar mass per year.

83 Poster

Gaseous environment in LLAGN: modes of interaction with compact star nuclear population

Zajacek, Michal Astronomical Institute, Czech Academy of Sciences

We employ radio-interferometric data in the mm regime of the ionized medium near the centre of the Milky Way (Sgr A*). We use previously published results (Kunneriath et al., 2012) about physical conditions, the shape and the filling factor of the 'mini-spiral' feature to estimate the probability of passages of the putative population of neutron stars of the nuclear cluster through the regions of enhanced density, and to assess different modes of the mutual interaction. Results for Sgr A* may serve as a paradigm for low-luminosity AGN (LLAGN).

84 Poster

Kinematic evidence for gravitationally triggered star formation

Zaragoza Cardiel, Javier Instituto de Astrofísica de Canarias

We have measured the surface brightness, velocity, and velocity dispersion of high luminosity star forming zones using data cubes in Hα emission from interacting galaxies, taken with the GH, a FaS Fabry-Perot spectrometer on the 4.2 m William Herschel Telescope. The results allow us to plot mean density and mass of the gas in the HII regions, showing two distinct relationships for high mass and low mass regions, in the ranges above and below $\sim 10^{6.5}\,M_\odot$. We use the velocity dispersion to show that the most luminous, most massive regions are gravitationally bound, while the lower luminosity regions are pressure bound. This is supported by our use of the virial parameter, which shows an almost constant value for the high mass clouds, but values higher than unity for the clouds in the lower mass range. In our work on the Antennae galaxies we show that the behaviour of the HII regions is similar to that of the molecular clouds, which also show a bimodal mass distribution with a split at $\sim 3 \times 10^6\,M_\odot$, and follow a similar mass-density function. These results beg the interpretation that the high mass HII regions are produced in the high mass molecular clouds, which are not disrupted quickly by the effects of the massive stars, and this is probably even true

(mutatis mutandis) for the lower mass range. We also show that the SFR varies superlinearly with velocity dispersion. Interacting galaxies are clearly useful laboratories for deriving the parametric variation of star formation in massive clouds.

85 Poster

Bar effects on ionized gas properties and dust content in galaxy centers

Zurita, Almudena Universidad de Granada

Numerical simulations indicate that bars are important agents to transfer material towards galaxy centers. However, observational studies devoted to investigate the effects of bars in the centers of galaxies are still far from being conclusive. We will present our results concerning the internal dust extinction and ionized gas properties for barred and unbarred galaxies separately. These results indicate differences between barred and unbarred galaxies, that are more apparent for certain ranges of parent galaxy properties.

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