KROSS: The KMOS Redshift One Spectroscopic Survey

Durham/Oxford KMOS GTO survey of ~1000 typical Star Forming Galaxies at z=1

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KROSS P.Is: Richard Bower (Dur), Martin Bureau (Ox)
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Ray Sharples, Helen Johnson,
Oxford: Andy Bunker, Matt Jarvis, Georgios Magdis,
Alfie Tiley
Others: David Sobral, Philip Best

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What drives SFRD rise to $z=1-3$?

- Mergers? Major? Minor? (e.g. Somerville+2001, Conselice+2008)


Hopkins & Beacom et al. 2006

‘Madau’ plot
What drives SFRD rise to $z=1-3$?

- Need to look at Typical ‘Main sequence’ star forming galaxies at $z=1$
- Main Sequence: Term for correlation between mass and SFR for star forming galaxies (Noeske+2007) evolves with $z$ (e.g. Elbaz+2011).
- KROSS targets the Main Sequence at $z=1$. 
• KMOS: multi object IFU on VLT
• 24 IFUs 3*3 arcsec size, pixel scale=0.2''/pix
• Wavelength range=0.8-2.5micron, zYJHK bands
• Placeable in 7.2 arcmin diameter circle
• Status: Observations began Autumn 2013
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KROSS: The KMOS Redshift One Spectroscopic Survey

- KROSS - 30 Night Durham and Oxford KMOS GTO collaboration
- Up to 1000 resolved Halpha observations of mass selected typical ‘Main Sequence’ star forming galaxies
- 1000 hour stack of all P92 targets

SFR and metallicity/AGN content
KROSS Science Goals

- Disc fractions
- Merger fractions
- Tully Fisher relation
- Dynamical masses
- Gas fractions
- Metallicity Gradients
- Winds/Outflows
KROSS Selection

- Fields: UDS, ECDFS, COSMOS, SA22
- Main sample: known spectroscopic redshifts
- Mass selection ($K_{AB}=22.5$, log(M)$\sim$9-9.5)
- Red and fainter galaxies lower priority
- HiZELS Halpha NB included too
KROSS P92

- First 240 targets observed in ESO period 92
- Efficiency: 93% detections. 80% resolved Halpha.
- Similar number to SINS in only ~7 nights
The KROSS Main Sequence at $z=1$

- SFR corrected for $A_v$-gas based on Herschel stacks

- Mass from full SED fitting

- Stott+ in prep.
The KROSS Main Sequence at $z=1$

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The KROSS Main Sequence at $z=1$

Velocity Field

- $z=0.8$ Main Sequence (Karim et al. 2011)

$\log(\text{sSFR [Gyr}^{-1}])$

$\log(\text{Stellar Mass } [M_\odot])$

M.S.

Stott+ in prep.
Preliminary Result: Dynamical masses

- Dynamical mass \(\sim 3\times\) Stellar mass. Therefore high gas fraction 60-70\% (\(- 10-20\%\) DM).
- Gas Fraction evolves with \(z\)
- We have ALMA time to get gas masses for a subset of KROSS
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Geach+2011
Rotation or Dispersion support?

V = V_{80}
sigma corrected for inst. and local dv/dr

Stott+ in prep.
Rotation or Dispersion support?

\[ V = V_{80} \]

sigma corrected for inst. and local \( \frac{dv}{dr} \)

\[ \text{Stott+ in prep.} \]

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Rotation or Dispersion support?

$V = V_{80}$
sigma corrected for inst. and local $dv/dr$

M.W. Stott+ in prep.
Rotation or Dispersion support?

M.W. Stott+ in prep.

\[ V = V_{80} \]

\[ \text{sigma corrected for inst. and local } dv/dr \]

\[ \log(\text{SFR} \ [M_\odot \text{ yr}^{-1}]) \]
Preliminary Result: Disc fractions

- Still a high fraction of rotation supported systems at $z \sim 1$ (see also SINS, KMOS3D etc)
- $V/\sigma < 8$ (typical low $z$ disc=10)
- dynamically hotter

Stott+ in prep.
Preliminary Result: Disc fractions

- Rotation fraction correlates with SFR and Mass (weaker). Hint of anti-correlation with sSFR.
- Decreases with redshift (careful with selection!)

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Kassin+ 2012

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Stott+ in prep.
Mass-Metallicity Relation

Pettini & Pagel 2004

Stott+ in prep.
Results: KMOS SV observations of HiZELS

- Metallicity gradient correlates with SSFR.
- High SSFR driven by metal-poor gas funnelled towards centre?
- Explains ‘evolution’ and discrepancies seen by others

Figure 3. The metallicity gradients for five representative galaxies from the KMOS-HiZELS SV sample. Left: The metallicity map with the annuli used to measure the metallicity gradient overplotted. Central: These are the individual spectra from each annuli going out in galactocentric radius. The red line is the fit to the H\alpha and [NII] emission lines. Right: The metallicity plotted against galactocentric radius. The red line is a fit to the data points.

Stott et al. 2014 arxiv:1407.1047
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Stott et al. 2014 arxiv:1407.1047
Preliminary Result: Metallicity Gradient

- Stott et al. 2014 arxiv:1407.1047 with KROSS points included.
- Follows similar trend (very preliminary)
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correct out the ssfr of MS