



Revisiting the Stellar Counter Rotation in NGC7217, NGC3521 and NGC7331 with VIRUS-W

Maximilian Fabricius, Lodovico Coccato, Ralf Bender, Niv Drory, Claus Gössl, Martin Landriau, Roberto Saglia, Jens Thomas, Michael Williams





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Introduction

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NGC 7217 WWFl u,g,r 24/26.10.2013 rbulge = 11"

NGC7217 HST F814W/F606W

Multiple rings (two stellar, one dust ring) without obvious bar but see Buta 1995 and Verdes-Montenegro et al. 1995

(R)SA(r)ab

NGC 7217 WWFI u,g,r 24/26.10.2013

Introduction



Merrifield & Kuijken (1994)

N

Friday 11 July 14

(R)SA(r)ab



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LMU

UŚM

 $\epsilon_{disk} = 0.17$ $\epsilon_{spheroid} = 0.04$ spheroid/T = 0.73

Maximilian Fabricius, OPINAS Seminar, Nov. 4, 2013



- Based on VIRUS for HETDEX
- Fiber based IFU spectrograph
- Rect. field of view: 105 " x 55"
- 267 fibers, core diameter on sky 3.2"
- 26% peak throughput, incl. atmosphere and telescope
- stellar dynamics mode: spectral range 4850 Å - 5475 Å resolution
 R ~ 9000 (σ^{inst} = 15 km/s)





VIRUS-W FoV

I.5h/dither, 3 dithers to fill IFU600s skynods

previously obtained 12 kinematic templates and 9 further standards

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Kinematic Extraction

- Based on Maximum Panelized Likelihood Method Gebhardt et al. 2000
- Extended to treat gas emission as in GANDALF Sarzi et al. 2006
- Recovers
 nonparametric
 LOSVD (critical here!)
- includes multiple template fitting





Kinematic Decomposition



Kinematic Decomposition stars kin. cold component



LMU

USM

stars kin. hot component



gas [O III]



Kinematic Decomposition stars kin. cold component



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gas [O III]



Kinematic Decomposition stars kin. cold component



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gas [O III]



Structure





60



Direct Decomposition

- based on pPXF Cappellari & Emsellem 2004
 & GANDALF
- fits two parametric LOVDs
- obtains separate template weights for the two components
- Coccato et al. 2011, 2013





Line Strengths





stars cold component

stars hot component



Formation scenarios



IAUS 309: Galaxies in 3D across the Universe, Vienna July 2014

Formation scenarios



IAUS 309: Galaxies in 3D across the Universe, Vienna July 2014

Formation scenarios

- Stellar disk dynamically young, relatively blue, chemically clearly distinct.
- Contains only ~ 20% of the light and much less in mass.
 Could not have "survived" merger that built the spheroid.
- Reformation after major merger from material surviving the merger. ^{e.g. Steinmetz & Navarro 2002; Hopkins et al. 2009}
- Reaccretion from stellar mass loss. e.g. Jungwiert et al. 2001; Bregman & Parriott 2009; Davis et al. 2011
- Minor mergers or cold accretion from IGM Thakar & Ryden 1996; Mazzuca et al. 2006; Eliche-Moral et al. 2010. Gravitational torque may have forced disk into alignment.

Conclusion

- Confirm the existence of two kinematic components: hot spheroid
 + cold disk **but** find them to be co-rotating
- Structural parameters from kinematic decomposition in agreement with photometry
- Stellar components of the two components are clearly separated in Mg - Fe space
- Spheroid most likely merger built, disk component reformed after the merger, inflow of low-Z material?
- For details see Fabricius et al. (2014, ApJ, 787, 26)