Optical integral field spectroscopy of z~0.1 quasar host galaxies

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Galaxy-Black Hole Coevolution

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1. Introduction

A morphological and multicolor study of low redshift quasar host galaxies by Jahnke et al. 2004 found:

- Quasar host galaxies show **diverse states of interaction** from undisturbed to strongly distorted quasars
- Bulge dominated galaxies are **bluer** compared with inactive galaxies and have **younger** stellar population
- Pointing direction of major merger, star formation and quasar activity connection?

Scientific aim: Study **kinematical properties** of 19 z~0.1 type 1 quasar host galaxies using integral field spectrograph to look for **merger signatures,** analyze **spatially resolved ionization state** of interstellar medium and investigate **stellar population of** the host galaxies to test a merger – star formation – AGN connection.

2. Data and measurements

We use a complete, flux-limited sample from the Hamburg/ESO Survey of 19 type 1 quasars with $-24.9 < M_V < -21.7$ and $0.06 < z < 0.2$. Morphologies range from disk dominated to bulge dominated and with dynamic states from isolated to interacting. We present recent results using spectroscopic observation from the VLT/VIMOS Integral Field Unit.

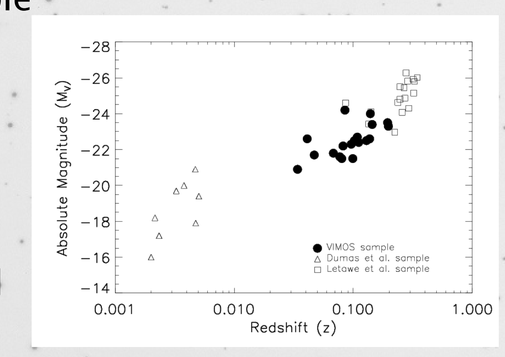

Fig.1. The VIMOS sample

Subtraction of the QSO contribution (see Christensen at al. (2006) and Husemann et al. (2008) was used to get quasar host galaxy spectrum free from quasar contamination. We modeled emission lines using Gaussian profiles to produce quasar-free subtracted 2D intensity maps and ionized gas velocity fields for the host galaxies, mostly in the Hα and [OIII] emission lines. We compute black hole parameters from modeled Hβ lines in the spectrum.

3. Results: velocity fields

We present four representative velocity fields of ionized gas in the quasar host galaxies and classified into two main classes, undistorted, clearly distorted plus "unclear" class.

Undistorted velocity fields

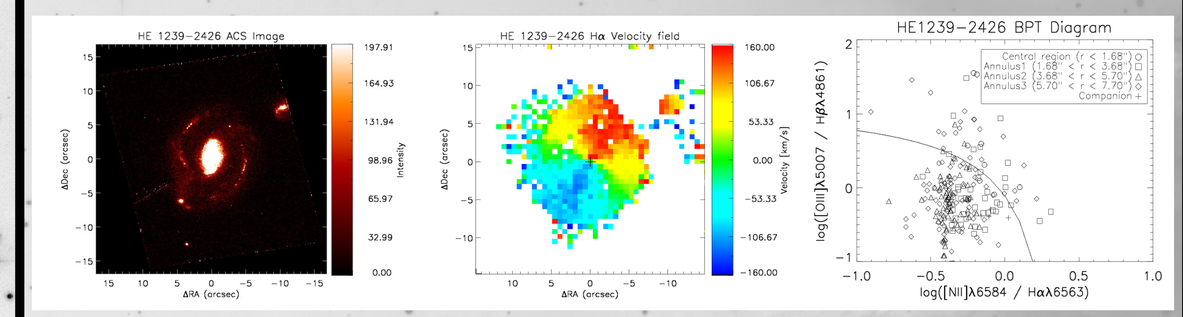

Fig.2. Left: HST/ACS F606W image of HE1239-2426, a spiral galaxy. Tightly wounded arms and several knots in the spiral arms are visible in the ACS image. A companion galaxy is located at North-East and still within VIMOS field of view. Middle: Velocity field shows fairly regular kinematics and reveals a classical "Spider Diagram". Right: Spatially resolved BPT diagram for the host galaxy. We divided host galaxy into four region, a central region and three annuli surrounding central region. The theoretical demarcation line from Kewley et al. (2001) and it shows outside the center star formation dominates.

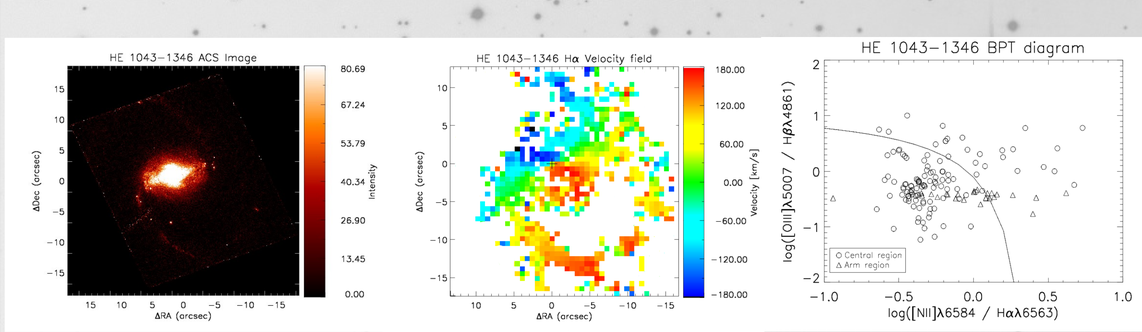

Fig.3. HE1043-1346 is a barred spiral galaxies with regular velocity field. Again the quasar only dominates in the central region and star formation outside.

3. Results: velocity fields (continued)

Distorted velocity fields

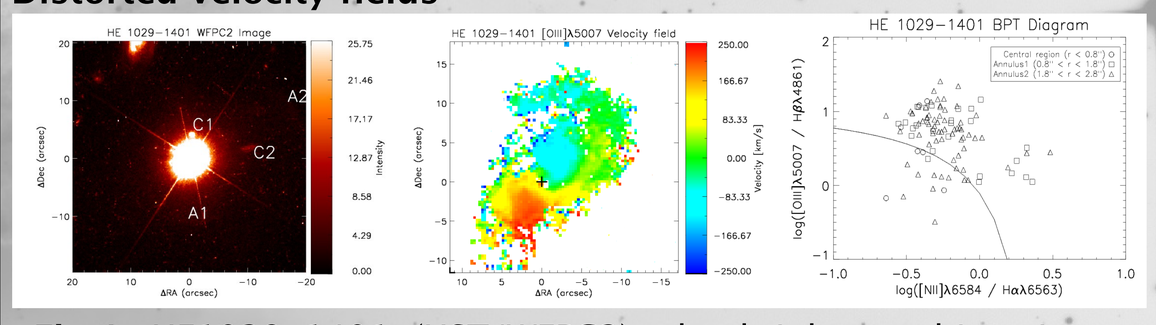

Fig.4. HE1029-1401 (HST/WFPC2), the brightest object in our sample, is an elliptical galaxy with two possible companion nearby (C1 and C2 but no redshift information). A tidal feature signature can be seen from ionized gas distribution. The velocity field displays rotation in the inner part and distorted in the outer part. A tidal (arc structure) and metallicity of the ionized gas suggest a recent minor merger history, for detailed analysis see Husemann et al. 2010. The BPT diagram for HE1029-1402 shows that most of the ionized gas is in the host galaxy ionized by central quasar.

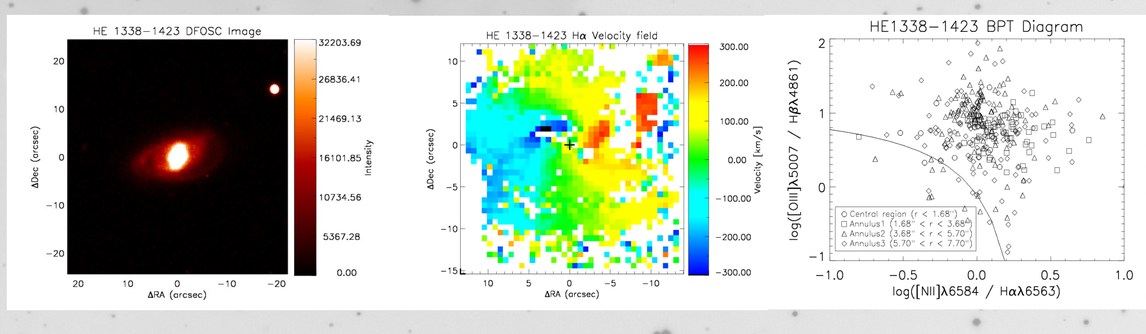

Fig.5. A DFOSC image of HE1338-1423, a spiral galaxy with bulge and possible bar. Middle panel: Velocity fields shows a rotation profile with substantial twist/distortions. The quasar in the center responsible for ionize the gas in the host galaxy.

4. Take home messages

From our 19 quasar velocity fields, **3 host galaxies show undistorted, 8 galaxies show distorted velocity fields and 8 host galaxies are categorized as unclear.**

The observed velocity fields ranging from perfectly regular to very distorted, indicating that while interaction processes or distortion by inflows or outflows can influence the observed gas kinematics of some of these luminous sources, for others, the presence of a completely undisturbed velocity field indicates that **major merging can not be the only or not even dominant fueling mechanism** for those quasars. These results indicate that in this regime, **secular mechanisms also can fuel** quasar activity.

5. References

Christensen et al. 2006, A&A, 459, 717

Husemann et al. 2008, A&A, 488, 145

Husemann et al. 2010, accepted for publication in A&A

Jahnke et al. 2004, MNRAS, 352, 399

Kewley et al. 2001, ApJ, 556, 121

Acknowledgements

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Background image credit: ESO/WFI (Optical); MPIfR/ESO/APEX/A.Weiss et al. (Submillimetre); NASA/CXC/CfA/R.Kraft et al. (X-ray)