Highlight talk session 6
Wednesday 16:25

• Carniani
• Sadler
• Husemann
• Burtscher
• Scharwaechter
AGN outflow at redshift z=2.5
Stefano Carniani, A. Marconi, R. Maiolino, et al.

VLT/SINFONI observations of a sample of 6 quasar:

- $z \sim 2.3 - 2.5$
- $L_{\text{bol}} \sim 10^{47} - 10^{48}$ erg/s
- Target [OIII] 5007 line

Fast (> 100 km/s) blue-shifted emission with very large velocity dispersion (FWHM > 1000 km/s)

The strong blue asymmetry of the line suggests the presence of outflow ionized gas that, given the velocities, can only be ascribed to the AGN
$[\text{OIII}]_{\lambda 5100}$ as a tracer of ionized outflows

$$M_{[\text{OIII}]_{\text{outflow}}} = 3.3 \times 10^7 M_{\odot} \left( \frac{C}{10^{[O/H]}} \right) \left( \frac{L_{[\text{OIII}]} }{10^{44} \text{erg/s}} \right) \left( \frac{<n_e>}{10^3 \text{cm}^{-3}} \right)^{-1} \quad T_e = 10^4 K$$

$$\dot{M} \approx \frac{M_{[\text{OIII}]_{\text{outflow}}}}{R_{out}} v_{out}$$

Outflow rate increases with AGN luminosity

- Ionized outflow assuming $n_e = 10^3 \text{ cm}^{-3}$
- Ionized outflow assuming $n_e = 10^2 \text{ cm}^{-3}$
- Molecular outflow (local AGN)
- Molecular outflow (local starburst)

Carniani et al. (in prep)
Cicone et al., 2014
The momentum rate transferred by the AGN emission to the gas is given by the average number of photon scattering.

The [OIII] ionized gas is accelerated far from the AGN nuclear region.
Star formation in the host galaxy is strongly suppressed from the outflow.

In the region where the [OIII] outflow velocity is larger, the “narrow” line emission is suppressed.
Elaine Sadler (University of Sydney/CAASTRO) and the ASKAP FLASH team

Motivation: Use 21cm HI absorption to probe neutral atomic hydrogen in distant galaxies - unlike HI emission, sensitivity is independent of z

Intervening absorbers: Cosmic evolution of HI in galaxies
Associated absorbers: AGN fuelling and feedback
**ASKAP FLASH – the First Large Absorption Survey in HI**

**New parameter space opened up by ASKAP:**
- 30 deg² field of view (PAF) – survey whole southern sky (>150,000 sightlines)
- Wide bandwidth – e.g. simultaneous coverage of redshift 0.5 < z < 1
- Radio-quiet site – RFI levels exceptionally low below 1 GHz

FLASH early science 2015-16, full survey from 2016-17
HI absorption in nearby compact radio galaxies

(with James Allison, Steve Curran, Bjorn Emonts, Katinka Gereb, Elizabeth Mahony, Sarah Reeves, Martin Zwaan)

Australia Telescope Compact Array – targeted observations of ~40 compact radio galaxies at 0.04 < z < 0.1.

Used an automated Bayesian line-finding tool (Allison et al. 2012) to find and fit HI absorption lines.

HI detection rate ~10%, mixture of early- and late-type galaxies.

(Allison et al. 2012, 2013)
4 detections in 210 nearby radio-loud galaxies (z < 0.04)


Strong associated HI absorption linked to presence of OH/H₂O megamasers?

(with James Allison and Alex Meekin)
Probing the QSO-host galaxy connection with 3D spectroscopy

Bernd Husemann (ESO fellow)

L. Wisotzki (AIP), K. Jahnke (MPIA), S. F. Sanchez (UNAM), T. Davis (ESO), H. Dannerbauer (Uni Vienna), J. Hodge (NRAO), V. Wild (St. Andrews), D. Gadotti (ESO), S. Bekeraite (AIP)

QSO emission can be subtracted in 3D spectroscopic data!
Quenching of star formation by AGN feedback?

Extinction-corrected Hα emission as SFR tracer

- 18 QSOs at 0.027 < z < 0.2
- deep HR VIMOS IFU spectroscopy

Main sequence

- SFR in QSO hosts is diverse
- Major mergers above MS
- Several QSOs below MS

→ Signature of AGN feedback?
The star formation efficiency of QSO hosts

Combining VIMOS IFU & IRAM 30m sub-mm data

- Linear relation between SFR and H2 gas mass
- Only a few objects are significantly off the relation

⇒ Normal conditions for SF?
Spatially resolved comparison study of star formation in AGN and SF galaxies

Reconstructed Hα images

AGN galaxies

SF galaxies

- 20 AGN and 20 star forming galaxies
- Narrow stellar mass range
- Late-type and face-on galaxies
- Redshift $0.03 < z < 0.05$ and $\delta < 10^\circ$

- AGN distribution peaks at lower SFR than SF galaxies
- Need to be sure that the AGN is causing this change

➔ Comparison samples are the key to study the effect of AGN
The disappearance of the AGN torus

The nuclear non-stellar continuum in the near-IR

Leonard Burtscher, Ric Davies, Ming-Yi Lin, Gilles Orban de Xivry, David Rosario

Bottomline:
There is a strong correlation between the nuclear near-IR continuum and the X-Rays as well as nuclear mid-IR continuum, with no difference between type 1/2 AGNs

Burtscher et al. (soon to be submitted)
Probing the non-stellar continuum with SINFONI

- NGC 2110 1" off nucleus
- EW~10Å

- NGC 2110 nucleus
- EW~1Å

Likelihoods for AGN types

- LLAGNs (inactive)
- Seyferts

- Star-forming HII regions

- AGN continuum

- Central circle represents the radius at which the dilution factor is 2.

Maps of non-stellar continuum in three galaxies (NGC 3227, NGC 6300, and NGC 6814) where significant dilution of the CO bandheads is seen due to an equivalent width of the CO bandhead emission (corrected for obscuration) is available and listed in Table 1. In all 10 galaxies the first two CO bandheads at λCO(2-1) and λCO(3-2) were detected and fitted.

- Equivalent width of the CO(2-1) bandhead:
- Equivalent width of the CO(3-2) bandhead:

In this section we describe the tools of the trade used to analyze CO data and extract kinematics. The data cubes were spatially binned to a pixel size of 1 arcsec. In all cases the kinemetry procedure was used to determine the best position angle and axis ratio for the velocity field, to remove high-order noise from the raw kinematic extraction, and to recover the velocity and dispersion radial profiles. In some cases, the kinematics were also cleaned to emphasize that the impact of the finite beam size on the derived central value, we consider the trend of the dispersion from large to small radii and so will not significantly alter it; and when estimating the central value, we consider the trend of the dispersion from large to small radii and so will not significantly alter it.
Maps of CO (2.29 μm) absorption equivalent width
Equivalent Width (r)

And the reason is:

- Nuclear distribution: bimodality
- Intrinsic distribution: no bimodality

$r < 200 \text{ pc}$

$r > 200 \text{ pc}$

Gray shaded: with proper X-ray measurements
The non-stellar continuum

$L_{\text{bol}} \sim 10^{42}$ erg/s

- Need $\sim 10x$ better resolution to discriminate between stellar and non-stellar light in very weak AGNs...

- Tight correlation between near-IR non-stellar light and nuclear mid-IR
- no type 1/2 dichotomy, as in $L_{\text{mir}} - L_{\text{X}}$ relation
- but: perhaps some interesting outliers

Burtscher et al. (soon to be submitted)
3D view on ionised gas in Seyfert galaxies

Julia Scharwächter (Observatoire de Paris, LERMA)

NGC 5427 (Seyfert 2)

NGC 6300 (Seyfert 2)

This large-field IFU study is part of....
S7
Siding Spring
Southern Seyfert
Spectroscopic Snapshot Survey

Team
Michael Dopita¹, Prajval Shastri², Lisa Kewley¹, Julia Scharwächter³, Preeti Kharb², Jessy Jose², Rebecca Davies¹, Julie Banfield⁴, Ralph Sutherland¹, Elise Hampton¹, Harish Bhatt², Ramya Sethuram², Shweta Srivastava⁵

¹ Australian National University; ² Indian Institute of Astrophysics; ³ Observatoire de Paris; ⁴ CSIRO, Australia; ⁵ Gorakhpur University, India

Project
Optical integral field survey of >100 Seyfert galaxies

Data
Wide Field Spectrograph - WiFeS (Dopita et al. 2010)

Science
(Extended) NLR, NLR kinematics, AGN EUV continuum, chemical abundance, gas inflows/outflows, role of jet, ...
NGC 5427 and NGC 6300: Six WiFeS fields

Large data set for line diagnostics at ~3600-7000 Å
- E.g. HII region metallicities (using pyqz, Dopita et al. 2013)
First results: NGC 5427
Dopita, Scharwächter, Shastri, Kewley, Davies, Sutherland, Kharb, Jose, Hampton, Jin, Banfield, Basurah & Fischer, submitted

Using HII regions to constrain nuclear chemical abundances and the AGN photoionising continuum

Extended NLR:
Mixing between NLR spectrum and HII regions (cf. Scharwächter et al. 2011, Davies et al. 2014)