

SFR-radio relation and radio AGN host properties using LoTSS and MaNGA

Gaoxiang Jin (PhD student, MPA) Guinevere Kauffmann (MPA), Philip Best (ROE)

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gxjin@mpa-garching.mpg.de

Data: LoTSS and MaNGA

LOFAR Two-Meter (144MHz) Sky survey



DR2, Shimwell et al. 2022

Integral Field Spectroscopic source survey



Radio continuum imaging + Optical spectroscopic imaging

What's in the144MHz extragalactic sky?









Star formation





IFU tells us more

Advantage 2: 3D information





Advantage 3: comprehensive ancillary data

- Environment information
 - Gas information
- Morphology information
- Available value added catalogs

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Sample: MaNGA galaxies in LoTSS DR2

LoTSS detection rate ~ 45% (NVSS+FIRST detection rate ~ 7%)



Sample: MaNGA galaxies in LoTSS DR2

TUTORIAL

LoTSS DR2 optical-matching catalog, (Hardcastle+23) Algorithm + LOFAR Galaxy Zoo

https://www.zooniverse.org/projects/chrismrp/radio-galaxy-zoo-lofar







L_{144MHz} – SFR relation





- Tight relation, intrinsic error~0.2 dex
- In good consistent with result from different scales and wavelengths

Radio AGN classification



Appendix: MaNGA gives the AGN contamination to Ha

If you are interested, we can discuss later. Ji & Yan 2020, and Jin et al. 2021



AGN power: Jet vs. Narrow line region?



- We do not find strong correlation between Ha and 'jet power'
- Blackhole masses are needed to understand the connection between narrow line region and radio jets.

The role of radio AGNs in quenching



- At least half quenched massive galaxies have a jetted SMBH.
- Radio AGN feedback signatures after galaxy enter 'Green Valley'



Trigger mechanism: Galaxy merger?





Case 3





~13% isolated galaxies are RDAGNs ~18% mergers are RDAGNs →Mergers can trigger RDAGN

Only ~20% RDAGN are mergers \rightarrow Need other mechanism



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Preliminary result: Jet direction

Zheng+23, Strong RDAGNs tend to be slow rotators







Scenario



Summary

- Tight L_{144MHz} SFR relation with intrinsic error ~0.2dex, revealed by high quality IFU data.
- Radio AGNs selected by radio excess are massive, quenched galaxies, hardly overlap with optical AGNs.
- At least half SMBHs in massive galaxies is jetting.
- Indicating radio AGN feedback become dominant quenching mechanism for most massive galaxies.
- Radio 'jets' show random directions compared to the stellar rotation.

Thanks for attention!