MODELING STAR FORMATION AND AGN ACTIVITY IN SUB-mJy RADIO SURVEYS

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-Bologna, 22nd October 2015-
Which are sub-mJy sources?

**Star-forming Galaxies**
- Synchrotron emission via relativistic plasma from supernovae

**Radio Loud**
- Synchrotron emission from gravitational energy of SMBHs in the form of jets

**Radio Quiet**

**AGNs**
- 1.4 GHz

*Star-forming Galaxies*?
Radio Quiet AGNs

Rescaled version of Radio Loud AGNs

RQ luminosity function is extrapolated from RLs one
Radio Quiet AGNs

Rescaled version of Radio Loud AGNs

Padovani+15
Radio Quiet AGNs

Rescaled version of Radio Loud AGNs

Padovani+15
Radio Quiet AGNs

Bimodality with Radio Loud AGNs

- Different physical processes
- Different geometries
Radio Quiet AGNs

Bimodality with Radio Loud AGNs

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RLs dominated by non-thermal emission (jets)
RQs dominated by thermal emission (accretion disk)
Radio Quiet AGNs

Total power in RQ AGNs

Accretion onto BH

What about radio power?

Star formation
Modeling Star Forming Galaxies

physical, forward model
HIGH REDSHIFT (Z>1)

phenomenological, backward approach
LOW REDSHIFT (Z<1)

UV + IR
Star Formation Rate functions

Radio luminosity functions

number counts
Modeling Star Forming Galaxies


See poster
Modeling Star Forming Galaxies: high-z

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Modeling Star Forming Galaxies: high-z

Gas infall

\[ \dot{M}_{\text{inflow}} = \alpha_{\text{res}} \times 10^{-3} \dot{M}_* \]

Black Hole accretion

\[ \epsilon c^2 \dot{M}_{\text{accr}} = L_{\text{AGN}} = \lambda L_{\text{Edd}} \]
Modeling Star Forming Galaxies: high-z

Modeling Star Forming Galaxies: high-z

$SFR \propto M_{\text{reservoir}}$


SFR accretion rate
Modeling Star Forming Galaxies: high-z

Lightcurves timescales ➔ $P(\text{AGN})$ inside SF galaxy

$Lapi+14, \textit{ApJ}$

$SFR \propto M_{\text{reservoir}}$

reservoir

accretion disk
Modeling Star Forming Galaxies: low-z

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Modeling Star Forming Galaxies: low-z

- observed star formation rate functions (IR+UV)
- observed proportionality between the mass in stars and the BH mass
- Following Bonato et al. 2014 on the sample of Chen et al. 2013
Modeling Star Forming Galaxies + RQ AGN: low-z

\[
\text{Probability of having an AGN inside the star forming galaxy}
\]

Gaussian distribution

\[
\text{Mean} = \frac{L_{\text{tot}}}{L_{\text{ir}}} = 0.054\left(\frac{L_{\text{ir}}}{10^{12} L_\odot}\right)^{0.08}
\]

\[
\text{Sigma} = 0.69
\]
Number counts: Radio Quiet AGNs

Mancuso, Lapi +15B, in prep
Luminosity functions: Radio Quiet AGNs & star formation

Mancuso, Lapi +15B, in prep
Conclusions & future plans

- Basing on a state of the art galaxy/BH coevolution model vs the observed sub-mJy cts at 1.4 GHz, we statistically confirmed that the radio emission from radio quiet AGNs is mainly due to star formation.

- We are currently working to predict the redshift evolution of RQ luminosity function.
Conclusions & future plans

- We have in plan to extend predictions to higher frequencies.

- We want to investigate the location of sf galaxies and RQ AGNs on the SFR-M*star and Lagn-SFR planes, as a test of the underlying coevolution model.
Thank you!