Multiwavelength morphological study of active galaxies in the BASS survey

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Introduction

Morphology is one of the key parameters for understanding the whole picture of galaxy formation and evolution along cosmic time (Conselice, 2014). It gives us an important information about galaxy structure and how other parameters such as environment (van der Wel, 2008), interactions and mergers, nuclear activity in galaxies (Moles et al., 1995), interstellar medium (IMS), etc., affect morphology and vice-versa. It also have a connection with other galaxy properties such as stellar mass (Brinchmann and Ellis, 2000), star formation rate (SFR), metallicity (Harris et al., 2015), black hole mass (BHM), luminosity (Sanders and Mirabel, 1996) and colors (van der Wel, 2008), etc.

Studying the morphology of a large sample of AGN at different wavelengths and comparing it with other AGN properties such as black hole mass and Eddington ratio, can help us in understanding better the connection between AGN and their host galaxies, and the role of nuclear activity in galaxy formation and evolution.

Swift/BAT is an all-sky ultra-hard X-ray survey in 14 - 195 keV energy range. It is the only ultra hard X-ray instrument surveying the whole sky continuously. 1210 objects are identified on the first 70 months of operation (Baumgartner et al., 2013), in the local universe z<0.2.

Objective of the study

To study the multiwavelength morphological properties of ultra hard X-ray detected AGN and their correlation with other AGN properties for understanding better the connection between AGN and their host galaxies (and vice-versa).

Specific Objectives

- → Perform the multiwavelength morphological classification of the BASS AGN sample;
- → Compare the morphological classification obtained at different wavelengths;
- → Compare the results of multiwavelength study with previous ones known by analyzing simply optical data;
- → Study the correlation between multiwavelength morphology and other AGN properties (such as black hole mass, bolometric luminosity, Eddington ratio, stellar mass and SFR)

Data

The ultra-hard X-ray detected sources comes from BASS survey.

- 711 are ultra hard X-ray detected AGNs which are relevant for the study (Sy1, Sy2, blazars, QSOs, and sources classified as other AGNs in the BASS catalog).
- We went through the visual classification of a large sample of active galaxies in optical, radio, and X-rays. We used surveys:
  - → SDSS for optical sources
  - → FIRST and NVSS for radio sources, and
  - → XMM-Newton and Chandra for X-ray sources
- In order to compare our visual morphological classification of the optical sources we used Galaxy Zoo and Kuminski classifications.

Results

- Majority of the AGN (42%) are hosted by spiral in optical, to be quiet in radio, and to have compact morphologies in X-rays.
- Early type (ET) in optical and radio loud (RL) in radio have slightly higher BHM, bolometric luminosity (Lbol) and stellar mass, and lower accretion rate in the case of ET galaxies.

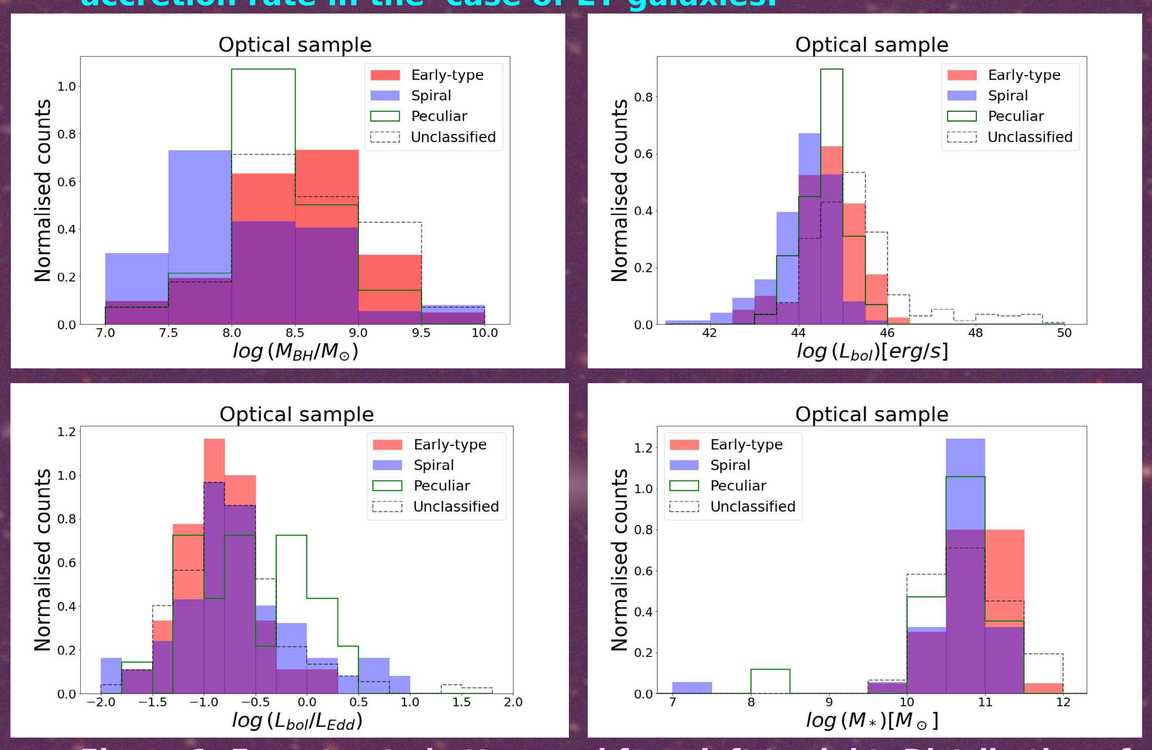
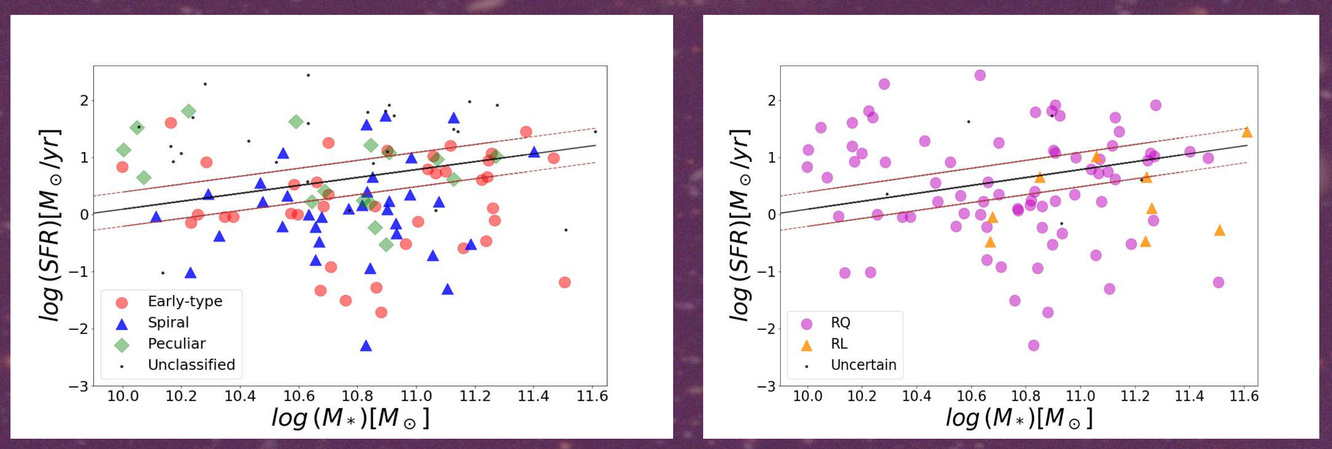


Figure 1: From top to bottom and from left to right: Distribution of BHM , Lbol , λEdd, and M∗ of optically classified sources. Different color of the histogram is related with different morphological type, as indicated on each plot.



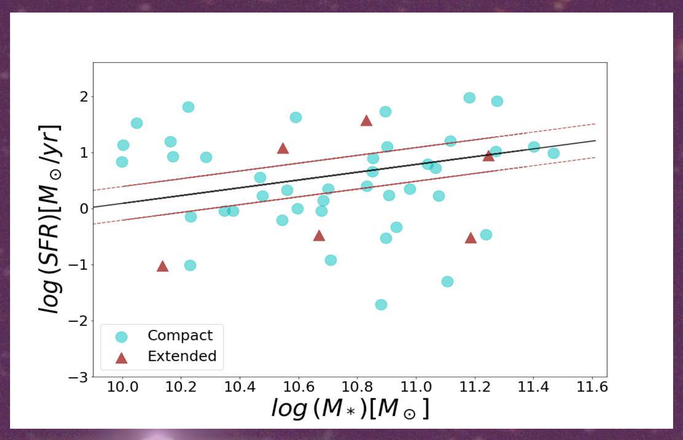


Figure 2: The SFR as a function of stellar mass for optical (top left), radio (top right), and X-ray (bottom) sources. Different symbols are related with different morphological types, as indicated on each plot. The black dash line indicates the galaxy main sequence of star formation (Schawinski et al., 2014).

Conclusions

- → The ultra hard X-ray detected AGN sources can be hosted by all morphological types. In large fraction (42%) they are hosted by spiral in optical, RQ in radio, and compact in X-ray.
- → Comparing morphologies with other AGN properties the ultra hard X-ray detected AGN follow previously obtained relations, where ET in optical and RL in radio have slightly higher BHM, Lbol and stellar mass, and lower accretion rate in the case of ET galaxies.
- → Non-negligible number of sources, with diverse morphologies are also located and/or above the MS suggesting that AGN feedback might have more complex influence on the SF in galaxies then simply quenching it.

References

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Acknowledgment

My thanks go to the Ethiopian Space Science and Technology Institute for all its support, and to the Astronomy and Astrophysics Research and Development Department. I would like to acknowledge also my sponsor Debre Berhan University.