Radio detected galaxies are more obscured than optically selected galaxies

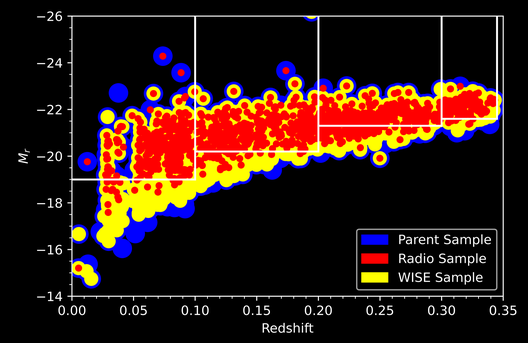
Tania Ahmed, Andrew Hopkins

Contact: ummeetania.ahmed@mq.edu.au

Background

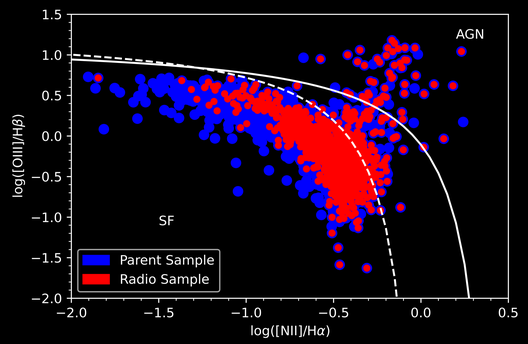
- Galaxy and Mass Assembly (GAMA, Driver et al. 2022), is a Multiwavelength photometric and spectroscopic survey which covers an area over 286 deg2 with 300,000 galaxy spectra across five sky regions (G02, G09, G12, G15, and G23).
- Evolutionary Map of the Universe (EMU, Norris et al. 2021), is an ongoing deep radio continuum sky survey with the Australian SKA Pathfinder (ASKAP), covering the Southern Hemisphere up to $\delta < +30°$ at a resolution of $\sim 15''$ FWHM, which is expected to generate a catalogue of about 40 million galaxies at 943 MHz.
- We use early science data taken with the ASKAP telescope for the EMU survey in the GAMA G23 field due to the wealth of complementary photometric and spectroscopic data.
- We investigate the degree of obscuration in star forming galaxies, and demonstrate that the radio detected population has on average higher levels of obscuration than the parent optical sample, arising through missing the lowest Balmer decrement (BD) and lowest mass galaxies, which are also the lower star formation rate (SFR) and metallicity systems (Ahmed et al. 2024) .

Sample Selection

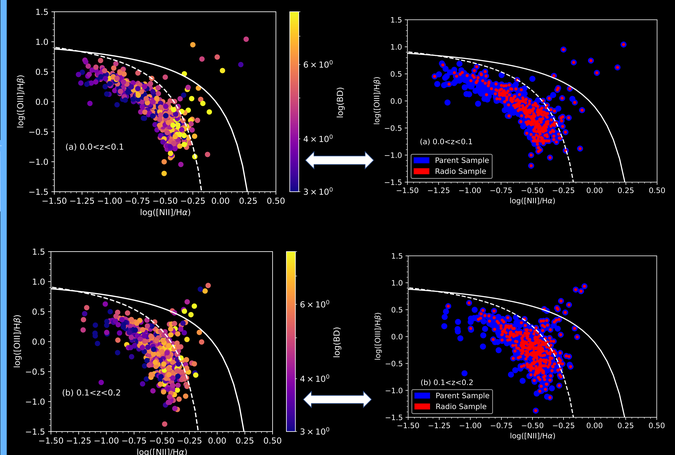


Distribution of magnitude M_r with redshift, illustrating the four volume limited samples with all the optical parent galaxies (blue), radio detections (red), and those with WISE detections (yellow) .

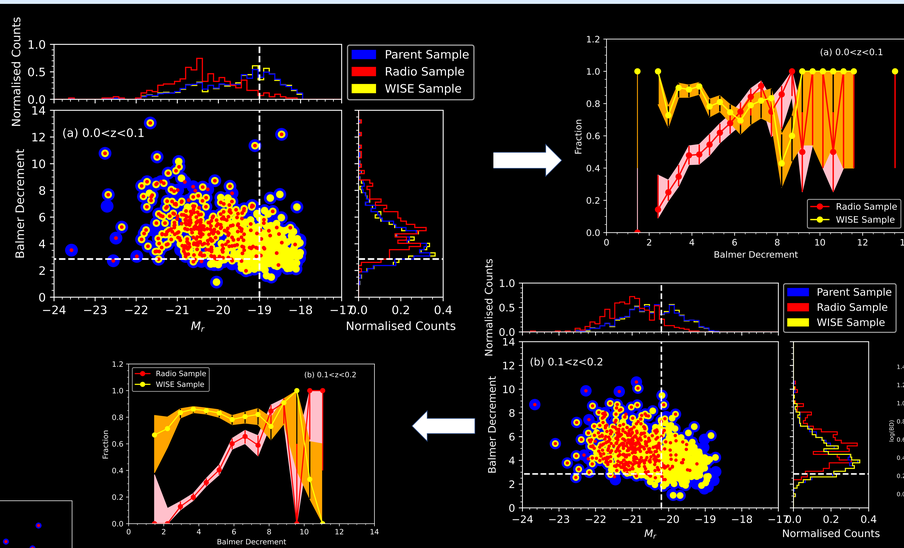
Results



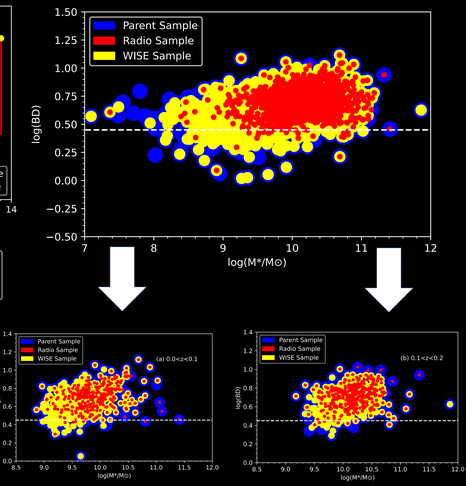
Spectral diagnostic diagram illustrating the selection of star forming galaxies (SFGs) showing the parent sample (blue) and the radio subset (red).



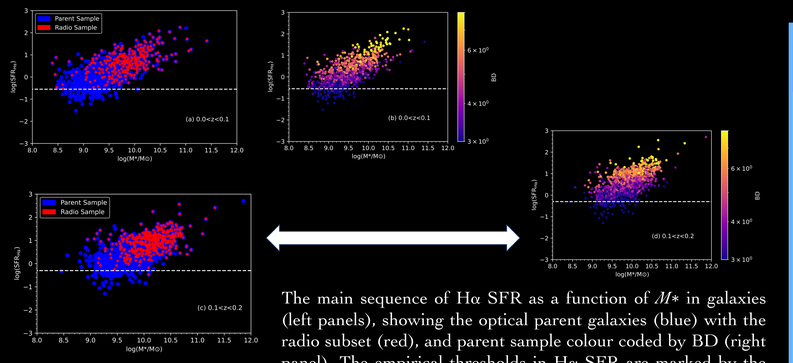
Spectral diagnostic diagram showing parent sample, colour coded by BD value, for the two volume-limited redshift bins (left panel), and comparing the parent sample in blue with the radio subset in red (right panel).



Comparison of M_r-BD distribution between the parent sample (blue), WISE (yellow), and radio (red). The vertical dotted lines represent the Mr limits for each redshift bin, and the horizontal dotted line represents the nominal Case B value of BD=2.86.



Balmer decrement as a function of stellar mass for the parent sample (blue), radio detected subset (red), and WISE subset (yellow). The horizontal dashed line represents the nominal value of BD=2.86.



The main sequence of Hα SFR as a function of $M*$ in galaxies (left panels), showing the optical parent galaxies (blue) with the radio subset (red), and parent sample colour coded by BD (right panel). The empirical thresholds in Hα SFR are marked by the horizontal dashed lines.

Analysing these results indicate that while the majority of high mass galaxies have radio counterparts, in the low mass galaxy population only the highest obscuration systems appear to. This leads to a statistically significant difference in the obscuration properties for the radio detected subset. The low obscuration, low mass galaxies do not show radio emission, although it would be detectable if present at the same level as their higher obscuration counterparts.

Summary

- We analysed four volume-limited samples, defined to ensure that galaxies should lie above our radio detection limits.
- The radio detected systems recover almost all of the galaxies at high optical luminosities, but lack the low optical luminosity and low BD galaxies.
- The radio detected subsets are lacking the least obscured (lowest BD) galaxies at the lower mass end of the samples.

References

- Ahmed, U. T., Hopkins, A. M., et al. 2024, PASA, 41, e021
- Driver, S. P., Bellstedt, S., Robotham, A. S. G., et al. 2022, MNRAS, 513, 439
- Norris, R. P., Marvil, J., Collier, J. D., et al. 2021, PASA, 38, e046