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Unveiling HI galaxy scaling relations at z~0.4 with spectral stacking applied to MeerKAT datacubes

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Neutral hydrogen (HI) is a key ingredient in the baryonic picture of our Universe and understanding its abundance, redshift evolution, phenomenology and role in astrophysical and cosmological processes on different scales is currently the subject of an intense observational and theoretical effort by the community. In particular, HI is regarded to play a major role in galaxy evolution, being the basic constituent of molecular hydrogen and thus of paramount importance for triggering star formation. Furthermore, its abundance and distribution are strongly sensitive to the large-scale structure of the Universe (LSS), being therefore potentially an excellent proxy for the galaxies-LSS connection. In this scenario, galaxy scaling relations involving HI have been thoroughly explored in the Local Universe (z<0.1), finding tight trends linking HI mass, stellar mass and SFR. However, they have remained largely unexplored at z>0.1 due to the intrinsic faintness of the 21cm line and the consequent difficulty in performing direct detections for a statistically complete sample of galaxies. To this end, spectral stacking have been widely resorted to as a cheap and efficient technique to increase the signal-to-noise ratio and perform a mean HI mass detection, at the expense of information on single galaxies. In two forthcoming papers, we investigate (i) the impact of technical and instrumental aspects (e.g. source confusion, primary beam correction and weighting schemes, among others) on HI mass estimates derived through stacking of sources with realistic spatial distribution in mock datacubes mimicking real MeerKAT observations (Sinigaglia et al. 2021c, in prep.) and (ii) perform a measure of galaxy scaling relations in the HI mass-stellar mass-SFR plane at a mean redshift z~0.4, possibly addressing the potential evolution of such relations from z=0.5 to z=0 using MIGHTEE-HI MeerKAT real datacubes (Sinigaglia et al. 2021d, in prep.). In particular, in (ii) we select a sample of ~13000 galaxies in the COSMOS and XMM-LSS fields at z<0.6, with spectroscopic redshift known from literature and stellar mass and SFR estimates obtained through CIGALE SED-fitting. We argue that such studies are in position of setting new standards of data exploitation in the context of the future SKAO and its pathfinders.

Reasearch area

HI galaxy science

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