

MeerKAT HI and Radio Continuum Observations of a Unique Grand-Design Spiral Galaxy and its Mpc Scale Radio Jets

Abstract

MeerKAT observations in L-band and 32K channel mode is proposed to investigate neutral hydrogen gas-dynamics and large-scale radio continuum emission in a unique, massive spiral galaxy 2MASX J23453268-0449256 at $z=0.0755$, which has two giant radio lobes on 1.6 Mpc scale, but no central bulge. It shows very fast rotation speed ~ 430 km/s at $r = 20$ kpc. It is hazy how such extremely massive, rotationally supported spiral galaxies have formed, as it depends on poorly understood non-linear baryonic physics and complex interaction with the dark matter halos. MeerKAT data will be vital for understanding this. Our observations will address some most important questions like; how does the circum-galactic gas cool in galaxies and how star formation is fuelled or quenched, and what are the dominant feedback processes for quenching the SFR in such massive galaxies - morphological versus AGN feedback? Sensitive HI-data will map out the distribution of cold HI-gas, provide a census of 'missing' baryons, and will distinguish between models of dark matter. Since we are probing a universal mechanism of galaxy evolution, answering these questions even for a single spiral galaxy will be a powerful test of the galaxy formation and role of AGN feedback. We also aim for high sensitivity radio continuum emission and spectral index maps of FR-II inner double and the faint, steep-spectrum outer radio lobes. This will provide key information on the non-thermal energy content of jets, AGN duty-cycle and spectral-ageing properties of the lobe plasma at Mpc distance from the AGN in cosmic-web.