

A Complete Picture of Gas, Dust, and Stars in Six of the Best-Studied MeerKAT-Visible Galaxies

Abstract

We propose to use MeerKAT to observe HI and radio continuum to map the atomic gas and embedded star formation in 6 galaxies that have existing ALMA CO maps (tracing molecular gas) and VLT-MUSE optical spectroscopic imaging (tracing stars and ionized gas). Four of them also have multi-band optical imaging from the Hubble Space Telescope (tracing star clusters) and far infrared maps from the Herschel Space Observatory (tracing cold dust). Combining these data sets will yield a complete picture of each galaxy and allow us to: (1) measure the molecular-to-atomic gas ratio to constrain the physics of molecular cloud formation and destruction, (2) assemble a complete dynamical picture of these galaxies, stretching from the stellar-dominated inner disk to the dark-matter dominated outer halo, (3) measure how the dust-to-metals ratio, a crucial but barely explored quantity, depends on local conditions in each galaxy, and (4) test the use of resolved L-band radio continuum emission as a star formation rate tracer on intermediate, few hundred parsec, scales. All of these science goals depend on high quality, high (spatial and spectral) resolution of 21-cm line and continuum imaging, but those data are missing in these 6 targets (out of only 19 that have a similar combination of multi-wavelength data). MeerKAT is by far the best option to obtain such imaging for southern targets.