Feeding and Feedback in the Cosmic Web

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Filaments form the backbone of the Cosmic Web – agglomerations of galaxy groups residing within highways of gas, feeding the growth of massive structures located at the intersections, or nodes, of these celestial arteries. As smaller structures are accreted by more massive overdensities via such filaments, simulations and observations find evidence that galaxies are being "pre-processed", or modified, while residing in these infalling, less dense (group) environments. The cornerstone for isolating and understanding the baryonic processes at work is a mapping of the cold-gas reservoir as a function of environment.

We have obtained 32K MeerKAT data of a 20 square degree area centred on a rare example of a local (z~ 0.03) nexus of filamentary structures located in the KiDS-South/South Galactic Pole region. Within this agglomeration sits a dynamically young cluster, Abell 4038.

This project entails extracting the HI content of galaxies in this region and using available ancillary data (WISE-derived stellar and dust/star formation metrics) to investigate the star formation efficiency and gas deficiency in different regions of the nexus. To do this, we will make use of the existing detailed characterisation of the galaxy groups that form the nexus and its infalling filaments (van Kempen et al. 2024); see figure below.

This dataset provides the sensitivity to low HI masses crucial to studies in this regime, and the high spatial and spectral resolution can be used to examine detailed variations in the HI profiles of detected galaxies. In addition, this region boasts deep optical KiDS VST imaging (useful for e.g., morphological properties) available across the entire footprint, as well as Herschel far-infrared coverage.