The Extended HI Environment of PHANGS Galaxies with MeerKAT

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Abstract

Understanding the extended atomic hydrogen (HI) environment of galaxies is fundamental to constraining the processes of gas accretion, feedback, and environmental influence in galaxy evolution. In this study, we utilize high-sensitivity, high-resolution MeerKAT HI observations to investigate the outer HI morphology and kinematics of three representative galaxies from the PHANGS sample: NGC 7496, NGC 1512, and NGC 4535. These systems span a range of dynamical states and environments, enabling a comparative view of gas behavior beyond the optical disk. NGC 7496 a barred spiral galaxy hosting a Seyfert nucleus exhibits a markedly asymmetric and extended HI envelope. Notably, we identify two previously undetected HI-rich companion sources in its vicinity, suggesting possible minor interactions that may be influencing its outer disk structure and contributing to nuclear fueling via secular inflow mechanisms. NGC 1512, in active interaction with the dwarf galaxy NGC 1510, presents a well-defined HI bridge and tidal arms, offering a clear case study of satellite accretion, gas exchange, and disk disturbance at large galactocentric radii. In contrast, NGC 4535, located in the outskirts of the Virgo Cluster, displays evidence of environmental processing, with a mildly truncated HI disk relative to its stellar component and a warped outer structure, consistent with weak ram pressure stripping or tidal interactions. For each system, we present HI column density maps and radial surface density profiles. These are analyzed in conjunction with the inner star-forming disk traced by PHANGS CO and Hα imaging to explore the interplay between atomic gas reservoirs and star formation. Our findings underscore the diagnostic power of HI in characterizing both the ongoing assembly history and external perturbations of galaxies.