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Unveiling 3-D HI Structures in M31 and local dwarfs Using FMG

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In this talk, I will present a series of my recent work on HI kinematics, focusing on the Andromeda galaxy (M31), as one of the major key science projects of the Five-hundred-meter Aperture Spherical Radio Telescope (FAST). FAST's unparalleled sensitivity delivers high-dynamic-range HI data that reveal remarkably complex kinematic structures, while simultaneously posing challenges for data processing, Milky Way foreground subtraction, and subsequent dynamical analyses. Using our FMG toolkit (Lyu et al. 2023) to perform multi-Gaussian decomposition of the data cube, we successfully isolate distinct 3-D kinematic components (K. Zhang et al. 2025, in preparation), precisely remove Galactic contamination, clearly unveil the extended structure of M31's northern disk, and derive a refined rotation curve. Meanwhile, by applying FMG to the combined VLA + FAST data set, we further identify and disentangle a quasi-ring kinematic feature within the ~ 1 kpc nuclear region of M31 (Li et al. 2025)—a structure previously only hinted at in infrared observations.

In the future, we plan to deploy FMG on the integral-field unit (IFU) and interferometric HI data from The HI-KOALA IFS Dwarf Galaxy Survey (HI-KIDS; López-Sánchez et al. in prep) to conduct a comparative kinematic analysis of the stellar disk (absorption lines), ionised gas (emission lines), and atomic gas (21 cm HI emission) in nearby dwarf galaxies. At the spatial scale of individual H II regions, this approach will allow us to investigate the star-formation feedback onto galactic dynamics and thereby offer insights into the galaxy evolution of local dwarfs.

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