

Proposal Abstract:

Numerical simulations based on the Λ CDM model predict the formation of the cosmic web that consists of substructures such as filaments, sheets, and voids. Galaxy clusters and groups grow by continuously accreting intergalactic medium (IGM) from surrounding filaments. However, the observational hint of the cosmic web structure by large optical galaxy surveys such as SDSS only reveals individual and discrete galaxies that line up along the cosmic web. The predicted diffuse gas in the filaments that connect all the structures still lacks direct detection. To detect the cold neutral phase of IGM in the filaments and study its underlying physical processes in the formation of galaxies, we propose an ultra-deep mapping ($\sim 10^{16.6} \text{ cm}^{-2}$ at 3σ) over a region toward Mkn 501 in the Hercules Supercluster with FAST. With the ultra-deep FAST mapping of diffuse HI in the filaments, we aim to (1) detect the cold neutral IGM in the filaments of the cosmic web predicted by the Λ CDM model; (2) study the cooling and accretion of gas from surrounding filaments based on morphology and kinematics of the diffuse HI.