Proposal Abstract:

We propose to carry out 21cm SnapShotDec observations of HINSA toward a series of early-stage cold cores. Our aim is to identify cores undergoing the critical HI-H2 transition, evidenced by the 'double-peaked' HINSA, so as to constrain the pathways and timescales of cloud-formation. It remains uncertain whether H2 forms in cold environments gravitationally bound or not, leading to the ongoing debate between slow and rapid cloud-formation theories. As a product of cooling due to collisions with H2, HINSA serves as an excellent tracer of HI within cold cores. Cores in the midst of the HI-H2 transition may exhibit a ‘double-peaked’ HINSA structure due to higher conversion efficiency at their centers. This HINSA structure can trace the early evolution of HI-H2 transition and has not been discovered. The high velocity resolution of FAST offers us the opportunity to observe such structures. We will search for those cores in the HI-H2 transition phase with the ‘double-peaked’ HINSA, calculate their HI abundance, and determine the HI-H2 transition timescale. Along with 13CO and dust continuum data, we will ascertain the physical states of these cores and the conditions under which H2 forms, ultimately constraining the cloud-formation process from the early-stages.