

FAST Proposal Coverpage

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Project Name:

Investigating the HI to H2 Transition in a Molecular Cloud Ring

Project Summary:

(A 1 paragraph summary of your project, including its scientific goals and how you will address them. This information will be potentially public.)

*Molecular cloud formation is the first step towards star formation. Direct observation of the transition from atomic hydrogen (HI) to molecular hydrogen (H₂) in the interstellar medium is challenging. This is because that HI is “every where” in the Galactic plane and so the HI spectra are highly confused. HINSA, the HI narrow self-absorption towards cold clouds provides a tool to study the [HI/H₂] abundance ratio, a key ingredient in cloud formation. Encouraged by the recent **first detection of the HI to H₂ transition** using HINSA, here we propose HI mapping observations of a massive ring-shaped molecular cloud. The Ring Cloud is an outstanding target identified from our ESO Large Program SAMPLING on about 600 cold molecular clouds in the outer Galaxy (Wang et al. 2018). Analysis of the 12CO/13CO/C18O(1-0) and (2-1), HCO⁺, N₂H⁺ lines, together with multi-band dust maps from JCMT, APEX, and CSO, reveals a closed ring shape with radial velocity gradients. There is also some weak CO emission in the origin of the ring. This configuration provides a unique opportunity to study the **spatial variation of the [HI/H₂] abundance ratio** along the radius. The FAST HI data will be analyzed together with our CO and dust data. If this pilot observation is successful, we will propose a large sample from the ESO program in the next calls. Synergy of the FAST, ESO (SAMPLING: SMT "All-sky" Mapping of PLanck Interstellar Nebulae in the Galaxy, PI: Ke Wang), and PMO (MWISP: Milky Way Imaging Scroll Painting) data will open **a new era of routine observations of cloud formation**.*