FAST Proposal Coverpage

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Project Name: Atomic Hydrogen in Super Spiral Galaxies

(A 1-line title for your project)

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.)

We recently discovered a previously unknown class of superluminous, giant, and massive spiral galaxies at $0.1<z<0.3$, which place strong constraints on our understanding of galaxy formation and evolution. These super spirals are the largest and most massive disk galaxies, with diameters of 60-140 kpc, stellar masses of 0.2-1.0 $\times 10^{12}$ $M_{\odot}$, and extreme rotation velocities of up to 620 km/s measured in H-alpha. In spite of their large masses, most super spirals remain unquenched, following the star-forming main sequence. The very high mass and angular momentum of super spirals may allow them to survive mergers with smaller galaxies, without quenching star formation. A high gas fraction might also allow them to re-form their disks after a major merger. Currently no information exists as to the neutral gas content and kinematics of these galaxies. Here we propose a pilot program to observe the HI emission in 8 super spirals at $0.13<z<0.27$ with FAST for 19 hours. The proposed observations will enable us to measure their HI gas masses and rotational velocity profiles, in order to characterize their star forming potential, gas dynamics, and robustness against mergers. Measurement of their HI masses is also crucial to determine whether or not they rotate more quickly than expected for their baryonic mass. A gas mass fraction of >50% is necessary to bring them in agreement with the baryonic Tully-Fisher relation for less massive spirals. These observations will provide critical insights into the nature of the most massive and giant spiral galaxies. The high sensitivity and good RFI environment make FAST unique for the HI observations of these super spirals of $z > 0.1$, while our team's previous attempts using both Arecibo and GBT failed because of severe RFI.