

Proposal Abstract:

The origin of the initial spin and velocity of pulsars remains largely a mystery. Fortunately, the detection of two-dimensional (2D) spin-velocity alignment of young pulsars has provided insights into the origin of the rapid rotation and high velocity of pulsars. Analyzing the spin-velocity relation of the hyper-velocity PSR J0002+6216 will impose severe constraints on the neutron star kick mechanism. With previous observations of PSR J0002+6216 from Fermi and FAST, we have observed variations in interstellar rotation measure (RM), measured the direction of 3D spin axis and the proper motion (PM), and detected two glitches for the first time. Since the measurement of the PM from timing is entirely different from that given by VLBI, we propose to verify and improve PM measures by utilizing 48 hours of FAST time. Additionally, further FAST observations are crucial for verifying the detected anti-glitch-like structure and the RM variations, as well as for improving the measurements of the direction of the 3D spin axis. This project will explore the association between PSR J0002+6212 and SNR CTB1, and investigate the spin-velocity relation for a hyper-velocity pulsar. This will provide severe constraints on neutron-star kick models.