Proposal Abstract:

Recent discovery of a mysteriously unknown compact object of 2.5-2.67 M⊙ in the binary merger GW190814 perplexes the astrophysics and nuclear physics communities as this object's mass is in between the known maximum neutron star mass and the minimum black hole mass. High precision measurement of the mass upper limit of massive neutron stars is the key to resolve this important puzzle, which opens a new neutron star mass region for future exploration. Moreover, knowing the maximum neutron star mass is crucial for interpreting the electromagnetic signals of binary neutron star mergers, for studying the evolution path of massive pulsars during their long formation phases, and for constraining the high-density matter equations of state of neutron star cores. We propose to use the Five-hundred-meter Aperture Spherical radio Telescope (FAST), which has the advantage of superb sensitivity, to highly precisely determine the masses (currently with relatively large uncertainties) of eight massive neutron stars of compact binary millisecond pulsars through pulsar timing. The observation is expected to yield significant results and high-impact publications.