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Estimate on maximum characteristics strain of Continuous Gravitational Wave from systematic study on galactic pulsar population in context of various observational scenarios.

We have investigated the detection probability of continuous Gravitational Wave (CW) signals from the spinning neutron stars in our galaxy across a wide range of their spin frequency. For this purpose, we use observed neutron stars' spin frequencies and spin-down rates, observed with radio telescopes as provided in the Australia Telescope National Facility (ATNF) pulsar catalog. We model the CW strain as a function of source properties including spin frequency, spin-down, moment of inertia, ellipticity, and source-distance with varying degrees of realistic calculations and assumptions. Along with considering a fiducial value of the moment of inertia of the neutron stars, we have estimated the Newtonian and post-Newtonian (empirical approximation) values by computing it from the Nuclear Equation of State with the observed mass distribution of the neutron star population. We then apply observational constraints from NICER, XMM-Newton, and LIGO-Virgo Collaboration on the neutron star equation of State and select the valid ones. The estimations for all these source properties are combined to predict different observational scenarios for well-known search methods, fully coherent and semi-coherent, to detect CW signals with present and future-generation GW detectors.

Email

emanuel.hoque@saha.ac.in

Affiliation

Saha Institute of Nuclear Physics

Authors: Prof. MUKHERJEE, Arunava (Saha Institute of Nuclear Physics); HOQUE, Md Emanuel (Saha Institute of Nuclear Physics)

Presenter: HOQUE, Md Emanuel (Saha Institute of Nuclear Physics)

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