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Universal relations to measure neutron star properties from targetedr-mode searches

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R-mode oscillations of rotating neutron stars(NS) are promising candidates for continuous gravitational wave (GW) observations.In a recent work, we showed that imposing recent constraints on the NS EOS, the r-mode frequency range can increase upto 25% for the most promising candidate PSR J0537-6910 depending on the range of compactness. We also derived universal relations of the NS parameters, compactness and dimensionless tidal deformability with the r-mode frequency. In another subsequent publication, we investigate how these universal relations can be used to infer various NS intrinsic parameters following a successful detection of the r-modes. In particular, we show that for targeted r-mode searches in LVK data, these universal relations along with the "I-Love-Q" relation can be used to estimate both the moment of inertia and the distance of the NS thus breaking the degeneracy of distance measurement for continuous gravitational wave(CGW) observations. We also discuss that with a prior knowledge of the distance of the NS from electromagnetic observations, these universal relations can also be used to constrain the dense matter equation of state (EOS) inside NS. We quantify the accuracy to which suchmeasurements can be done using the Fisher information matrix for a broad range of possible, unknown parameters, for both thea-LIGO and Einstein Telescope (ET) sensitivities.

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