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Constraining the abundance of Galactic compact objects with continuous gravitational waves

Galactic spinning compact objects (COs) with non-zero ellipticity are expected to be sources of continuous gravitational waves (CGWs). Certain classes of hypothetical compact objects, such as neutron stars with quark cores (hybrid stars), and quark stars, are thought to have large ellipticities from theoretical considerations. These should enable such COs to produce CGWs detectable by the current LIGO-Virgo-Kagra GW detector network. Since no detections for CGWs, from searches in LIGO-Virgo data, have so far been reported, for the first time, we place constraints on the abundance of such exotic compact objects (eCOs) in our Galaxy. We formulate a Bayesian framework to place upper limits on the total number count (N_{tot}) of Galactic eCOs. We divide our constraints into two classes: an "agnostic"set of upper limits on N_{tot} evaluated on a CO spin-frequency and ellipticity grid that depend only on the choice of spatial distribution of COs; and a model-dependent set that additionally assumes prior information on the distribution of ellipticities and frequencies. Assuming a spin-frequency distribution for eCO's, we revisit the constraints on N_{tot} and we place upper limits on the ellipticities of eCO's which we find to be ϵ
$lesssim 2 \times 10^{-7}$ for the most optimistic case.

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