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High Frequency Gravitational Wave Bounds from Galactic Neutron Stars

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High-frequency gravitational waves (HFGWs) provide a unique probe into early Universe physics and exotic astrophysical objects. While current and future gravitational wave detectors work on lower frequencies, graviton-to-photon conversion in strong magnetic fields offers a complementary detection method suitable for HFGW. Neutron stars, with their extreme magnetic fields ($\sim 10^{13}$ Gauss), serve as natural laboratories for this process. For the first time, this study calculates, using realistic models of the Milky Way's NS population, the expected photon flux induced by the conversion of an isotropic stochastic gravitational wave background in the neutron star magnetosphere. We compare this photon flux to the observed flux from several telescopes and derive constraints on the stochastic gravitational wave background in the $10^8 - 10^{25}$ Hz range, finding competitive limits, particularly between $10^8 - 10^{12}$ Hz. Therefore, the galactic NS population is a powerful tool to probe the presence of an HFGW background.

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