

Detecting High-Frequency Gravitational Waves in Planetary Magnetosphere

High-frequency gravitational waves (HFGWs) carry a wealth of information on the early Universe with a tiny comoving Hubble horizon and astronomical objects of small scale but with dense energy. We demonstrate that the nearby planets, such as Earth and Jupiter, can be utilized as a laboratory for detecting the HFGWs. These GWs are then expected to convert to signal photons in the planetary magnetosphere, across the frequency band of astronomical observation. As a proof of concept, we present the first limits from the existing low-Earth-orbit satellite for specific frequency bands and project the sensitivities for the future more-dedicated detections. The first limits from Juno, the latest mission orbiting Jupiter, are also presented. Attributed to the long path of effective GW-photon conversion and the wide angular distribution of signal flux, we find that these limits are highly encouraging, for a broad range of frequencies including a large portion unexplored before.

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