Spacecraft-Spacecraft Doppler Tracking as a Xylophone Interferometer Detector of Gravitational Radiation

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ABSTRACT

We discuss spacecraft-spacecraft Doppler tracking as a detector of gravitational radiation, in which one-way and two-way Doppler data recorded on board the two spacecraft are time tagged and telemetered back to Earth. By linearly combining the four Doppler data sets[1], we derive a method for reducing by several orders of magnitude, at selected Fourier components, the frequency fluctuations due to the clocks on board the spacecraft. The nonzero gravitational wave signal remaining at these frequencies makes this $sp_{acecra}ft\text{-}s_1 1_{2Lccc1a}ft$ Doppler tracking technique the equivalent of a xylophone Interferometer detector of gravitational radiation[2,3]. In the assumption of calibrating the frequency fluctuations induced by the interplanetary plasma, a strain sensitivity of 3.7×10^{-19} at 10^{-3} Hz is estimated.

Experiments of this kind could be performed by future interplanetary multi-spacecraft missions planned by the National Aeronautics and Space Administration.

[1] R. F. C. Vessot and M. W. Levine, *Gen. Relativ. Gravit.* 10, 181 (1979).

[2] M. Tinto, *Phys. Rev. D*, 53, 5354, (1996)

[3] M. Tinto, *Phys. Rev.* D. In preparation.