A New Approach to Detecting Gravitational Waves via the Coupling of Gravity to the Zero-point Energy of the Phonon Modes of a Superconductor NADER INAN, UC Merced — The response of a superconductor to a gravitational wave is shown to obey a London-like constituent equation. The Cooper pairs are described by the Ginzburg-Landau free energy density embedded in curved spacetime. The lattice ions are modeled by quantum harmonic oscillators characterized by quasi-energy eigenvalues. This formulation is shown to predict a dynamical Casimir effect since the zero-point energy of the ionic lattice phonons is modulated by the gravitational wave. It is also shown that the response to a gravitational wave is far less for the Cooper pair density than for the ionic lattice. This predicts a charge separation effect which can be used to detect the passage of a gravitational wave.

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