Abstract Submitted
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An averaged-Lagrangian theory of self-consistent metric oscillations in matter[1] DEEPEN GARG, Princeton University, ILYA DODIN, Princeton Plasma Physics Laboratory — Existing theories of gravitational-wave (GW) coupling with matter are not directly applicable to GWs that are inhomogeneous in space and have more general polarization than those in vacuum. We propose an alternative, variational formulation of this problem, which also leads to the prediction of a nonlinear average force that a GW pulse exerts on massive particles. Using this result, we derive the wave equation for collective oscillations of the self-consistent metric with general polarization, and we reproduce the Jeans instability as a limiting case. Developing further on this equation, we present corrections to geometrical optics, which are of the same order as the GW-matter interaction term for near-vacuum waves. We have also re-calculated the linearized-gravity Ricci tensor in the presence of matter, on which there has been some disagreement in the community. Electromagnetic interactions can be added similarly, which, in the future, will lead to a generalized theory of plasma waves in the astrophysical context.

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