Abstract Submitted
for the APR20 Meeting of
The American Physical Society

Numerical Simulations of Gravitational Waves from Early-Universe Turbulence ALBERTO ROPER POL, University of Colorado, Boulder, AXEL BRANDENBURG, Nordita, SAYAN MANDAL, Carnegie Mellon University, TINA KAHNIASHVILI, None, ARTHUR KOSOWSKY, University of Pittsburgh
— We perform direct numerical simulations of magnetohydrodynamic turbulence in the early universe and numerically compute the resulting stochastic background of gravitational waves and relic magnetic fields. We obtain realistic kinetic and magnetic energy spectra, not considered in earlier analytic models. The computed gravitational wave spectra have a new universal form at low frequencies, with more power than suggested by earlier analytical models. The efficiency of gravitational wave production varies significantly with the physical form of the turbulence. For given energy in the turbulence, we find that the gravitational wave signal is stronger for irrotational flows than for vortical ones. Our results predict the details of gravitational wave spectra generated during the radiation-dominated epoch of the universe. They may be detectable in the stochastic gravitational wave background with the planned Laser Interferometer Space Antenna. This would lead to the understading of cosmological phase transition physics, which can have consequences on the baryon asymmetry problem and on the origin seed of observed magnetic fields coherent over very large scales at the present time. This work is based on the publications arXiv:1807.05479 and arXiv: 1903.08585.

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Date submitted: 01 Jan 2020 Electronic form version 1.4