ID de Contribution: **3** Type: **Non spécifié**

Turbulent production of polarized gravitational radiation from primordial helical magnetic fields

The generation of primordial magnetic fields and its interaction with the primordial plasma during cosmological phase transitions is turbulent in nature. I will describe and discuss results of direct numerical simulations of magnetohydrodynamic (MHD) turbulence in the early universe and the resulting stochastic gravitational wave background (SGWB). In addition to the SGWB, the primordial magnetic field will evolve up to our present time and its relics can explain indirect observations of weak magnetic fields coherent on very large scales. I will focus on magnetic fields produced at the electroweak phase transition and show that these signals may be detectable by LISA. Such detections could lead to the understanding of the underlying physics of cosmological phase transitions, 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. In particular, I will present the impact of helicity in primordial magnetic fields on the generation of polarized GW backgrounds and the efforts to detect this polarization by using a network of space-based GW detectors, as LISA and Taiji; see https://arxiv.org/abs/2107.05356.

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