ID de Contribution: **9** Type: **Non spécifié**

The gravitational wave signal from primordial magnetic fields in the Pulsar Timing Array frequency band

lundi 20 juin 2022 16:15 (25 minutes)

The NANOGrav, Parkes, European, and the International pulsar timing array (PTA) collaborations have reported evidence for a common-spectrum process that can potentially correspond to a stochastic gravitational wave background (SGWB) in the 1-100 nHz frequency range. I will present the scenario in which this signal is produced by magnetohydrodynamic (MHD) turbulence in the early universe, induced by a non-helical primordial magnetic field at the energy scale corresponding to the quark confinement phase transition. I will present the results of MHD simulations using the Pencil Code studying the dynamical evolution of the magnetic field and the resulting SGWB. The SGWB output from the simulations can be very well approximated by assuming that the magnetic anisotropic stress is constant in time, over a time interval related to the eddy turnover time. The analytical spectrum derived under this assumption features a change of slope at a frequency corresponding to the GW source duration that is confirmed with the numerical simulations. The SGWB signal can be compared with the PTA data to constrain the temperature scale at which the SGWB is sourced, as well as the amplitude and characteristic scale of the initial magnetic field. The generation temperature is constrained by PTA to be in the 2-200 MeV range, the magnetic field amplitude must be > 1% of the radiation energy density at that time, and the magnetic field characteristic scale is constrained to be > 10% of the horizon scale. The turbulent decay of this magnetic field will lead to a field at recombination that can help to alleviate the Hubble tension and can be tested by measurements in the voids of the Large Scale Structure with gamma-ray telescopes like the Cherenkov Telescope Array. arXiv:2201.05630

Auteur principal: ROPER POL, Alberto (APC)

Co-auteurs: CAPRINI, Chiara (APC); NERONOV, Andrii (APC Paris and Geneva University); SEMIKOZ, Dmitri (APC, Paris)