

Chiral dynamos and the origin of cosmic magnetic fields

Monday, 5 February 2018 17:05 (20 minutes)

Observations of blazar emission suggest that the intergalactic medium is permeated by large-scale magnetic fields. Most probably these are relics of primordial fields, the origin and evolution of which is still a mystery. In this talk, I will present a modified theory of magnetohydrodynamics, which describes a relativistic plasma like the one in the early Universe. We include additional terms and equations in order to follow the dynamics of the chiral chemical potential, i.e. the asymmetry between left- and right-handed fermions. This asymmetry can give rise to a new electric current along the magnetic field, an effect known as the chiral anomaly. Using high-resolution numerical simulations we study the amplification of weak magnetic seed fields shortly after the Big Bang. I will present different new dynamos which can operate in a relativistic plasma for both laminar and turbulent flows. These results, which are constrained by present-day observations of the intergalactic medium, can help us to better understand the role of magnetic fields in the early Universe.

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