

Axion hot dark matter bound, reliably

Friday, 17 February 2023 12:30 (20 minutes)

Axions originally emerged as low-energy remnants of the Peccei-Quinn solution to the strong CP problem. They also unavoidably contribute to the energy density of the Universe, quantified via the effective number of relativistic degrees of freedom (Δ_{eff}), which is constrained by cosmic microwave background experiments. In the talk, I will discuss the main axion-thermalization channel in the early universe at temperatures below that of the QCD phase transition, namely the axion-pion scattering, within the 2-flavor chiral perturbation theory (ChPT). Based on the leading order (LO) ChPT, the bound on the axion mass from Δ_{eff} is found to be approximately below the eV scale. However, considering the impact of NLO corrections, I will show that the perturbative chiral expansion breaks down for temperatures above 70 MeV, making the LO analysis not reliable. I will also discuss how to extend the EFT validity via unitarization techniques up to the deconfinement temperature, providing a reliable determination of the relic density of thermal axions decoupling after the QCD phase transition.

Presenter: PIAZZA, Gioacchino

Session Classification: Young Researchers Session