



ID de Contribution: 28

Type: Non spécifié

A Visible QCD Axion Portal to GeV-Scale Dark Matter

jeudi 28 septembre 2023 14:55 (20 minutes)

We consider a model involving a *visible* QCD axion with mass in the MeV range with flavour non-universal couplings to the Standard Model (SM) first generation quarks and with all the SM leptons. Such a heavy axion must evade a variety of stringent constraints which precisely fix the couplings to the SM fields. While this heavy axion cannot be a Dark Matter (DM) candidate, as it decays promptly, we show that it can act as a portal to a dark sector. By letting the axion couple to a DM fermion χ , we solve the Boltzmann equations to find the regions of the parameter space that yield the correct relic abundance. The coupling of the DM with the electrons is subject to indirect detection constraints from the CMB, while those with the light quarks induce elastic DM-nucleus collisions that are subject to nuclear recoil constraints. This restricts the allowed region of the parameter space that reproduces the correct relic abundance to the GeV mass range and PQ charges of $O(0.1)$.

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Classification de Session: Astro - HEP Phenomenology