

A Visible QCD Axion Explanation of the XENON1T Excess and of $(g-2)_\mu$

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The XENON1T excess in electron recoils can be fit by non-relativistic Dark Matter (DM) interactions mediated by a light pseudo-scalar in the MeV range. A tantalizing option for the pseudo-scalar mediator is the QCD axion that, in the mass range of a few MeV, is generally known as a “visible” axion. In our work we consider axion models with flavor non-universal couplings to Standard Model (SM) fermions, such that the resulting axion is pion-phobic and is able to evade a variety of very stringent phenomenological bounds (quarkonia decays, kaon decays and electron beam dump experiments). We study, in a model independent way, the complex phenomenology of this class of models and we also find that the Anomalous Magnetic Moments for both the electron and muon can be simultaneously explained. We finally construct a possible UV DFSZ-like model that is able to generate flavor non-universal couplings to SM fermions of the required size, and at the same time, to make the axion a portal to a Dark Sector. One of the consequences of this construction is to generate additional couplings and therefore enrich the already interesting phenomenology of the model. Specifically, we find that the unavoidable couplings of DM with light quarks and gluons induces elastic DM-nucleus collisions that, by using the XENON1T nuclear recoils, further constrains the parameter space.

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