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A Clockwork WIMP

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We embed a thermal dark matter (DM) candidate within the clockwork framework. This mechanism allows to stabilize the DM particle over cosmological time because it suppresses its decay into Standard Model (SM) particles. At the same time, pair annihilations are unsuppressed, so that the relic density is set by the usual freeze-out of the DM particle from the thermal bath. The slow decay of the DM candidate is induced by “clockwork” particles that can be quite light (rather than at some GUT or Planck scale) and could be searched for at current or future colliders. According to the scenario considered, the very same particles also mediate the annihilation process, thus providing a connection between DM annihilation and DM decay, and fixing the mass scale of the clockwork states, otherwise unconstrained, to be in the TeV range or lighter. We then show how this setup can minimally emerge from the deconstruction of an extra dimension in flat spacetime. Finally, we argue that the clockwork mechanism that we consider could induce Majorana neutrino masses, with a seesaw scale of order TeV or less and Yukawa couplings of order unity.

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