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Dark photon dark matter from axion oscillations

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We present a new mechanism for producing the correct relic abundance of dark photon dark matter over a wide range of its mass, extending down to 10−20 eV. The dark matter abundance is initially stored in an axion which is misaligned from its minimum. When the axion starts oscillating, it efficiently transfers its energy into dark photons via a tachyonic instability. If the dark photon mass is within a few orders of magnitude of the axion mass, mγ′ /ma = O(10−3 − 1), then dark photons make up the dominant form of dark matter today. We present a numerical lattice simulation for a benchmark model that explicitly realizes our mechanism. This mechanism firms up the motivation for a number of experiments searching for dark photon dark matter.

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