

Experimental targets for dark photon dark matter

Ultralight dark photon dark matter features distinctive cosmological and astrophysical signatures and is also supported by a burgeoning direct-detection program searching for its kinetic mixing with the ordinary photon over a wide mass range. However, dark photons cannot necessarily constitute dark matter across all of this parameter space. In this talk, I will show that in minimal models where the dark photon mass originates from a dark Higgs mechanism, early Universe dynamics can often breach the regime of validity of the Proca effective action. In the process, the dark sector can collapse into a cosmic string network, precluding dark photons as viable dark matter, and motivating certain regions of mass-coupling parameter space over others. I will then turn the argument on its head and address to what extent a discovery of a dark photon by any proposed haloscope would imply a more complex dark sector.

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