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Distinguishing between warm and cold dark matter using gaps in stellar streams

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A key prediction of the standard cosmological model – which relies on the assumption that dark matter is cold, i.e. non-relativistic at the epoch of structure formation – is the existence of a large number of dark matter substructures on sub-galactic scales. This assumption can be tested by studying the perturbations induced by dark matter substructures on cold stellar streams. Here, we study the prospects for discriminating cold from warm dark matter by generating mock data for upcoming astronomical surveys such as the Large Synoptic Survey Telescope (LSST), and reconstructing the properties of the dark matter particle from the perturbations induced on the stellar density profile of a stream. We discuss the statistical and systematic uncertainties, and show that the method should allow to set stringent constraints on the mass of thermal dark matter relics, and possibly to yield an actual measurement of the dark matter particle mass if it is in the O(1) keV range.

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