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Constraining the nature of Dark Matter with the Lyman alpha forest

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The observed Lyman-α flux power spectrum (FPS) is suppressed on scales below ~ 30 km s−1. This cutoff could be due to the high temperature, T0, and pressure, p0, of
the absorbing gas or, alternatively, it could reflect the free streaming of dark matter particles in the early universe. We perform a set of very high resolution cosmological hydrodynamic simulations in which we vary T0, p0 and the amplitude of the dark matter free streaming, and compare the FPS of mock spectra to the data. We show that the location of the dark matter free-streaming cutoff scales differently with redshift than the cutoff produced by thermal effects and is more pronounced at higher redshift. We, therefore, focus on a comparison to the observed FPS at z > 5. We demonstrate that the FPS cutoff can be fit assuming cold dark matter, but it can be equally well fit assuming that the dark matter consists of ~ 7 keV sterile neutrinos in which case the cutoff is due primarily to the dark matter free streaming.

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