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# Effects of a Hidden Sector On the Matter Power Spectrum

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Effects of A Hidden Sector on the Matter Power Spectrum

The absence of dark matter signals in direct detection experiments and collider searches has prompted interest in models in which dark matter belongs to a hidden sector minimally coupled to the Standard Model. In these scenarios, a long-lived massive particle might come to dominate the energy density of the early universe temporarily, causing an early matter-dominated era (EMDE) prior to the onset of nucleosynthesis. During an EMDE, matter perturbations grow more rapidly than they would in a period of radiation domination, which leads to the formation of microhalos much earlier than they would in standard cosmological scenarios. These microhalos generate detectable dark matter annihilation signatures, but the observational constraints on these signatures are highly sensitive to the small-scale cut-off in the matter power spectrum. We discuss the effects of an EMDE on the matter power spectrum, focusing on cases where the dark matter belongs to a hidden sector. In this scenario, the particle that dominates the Universe during the EMDE was initially relativistic, and the small-scale cut-off in the power spectrum is set by its pressure support. We relate the resulting cut-off scale to the particle mass and discuss how the properties of the hidden sector relate to the dark matter annihilation signal in these cases.

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