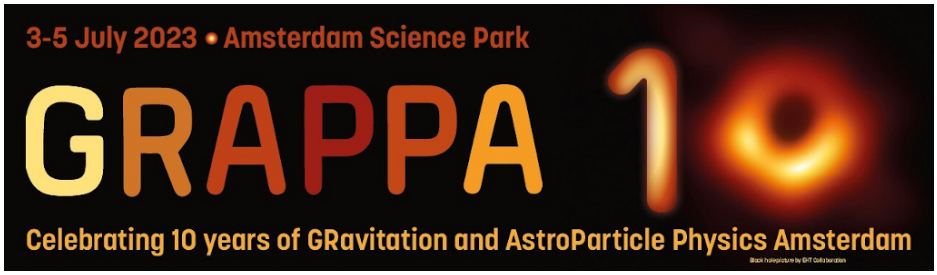

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Probing Hidden Sector Dark Matter Using Early Matter Domination

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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 observable signatures, but the 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 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 power spectrum cut-off to the hidden sector properties and the particle mass and discuss avenues for constraining such scenarios using dark matter annihilation signals, gravitational microlensing and pulsar timing arrays.

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