Probing ultra-light axion dark matter with the kinetic SZ effect

GERRIT FARREN, DANIEL GRIN, Haverford College, ANDREW JAFFE, Imperial College London — We derive mean pairwise velocity spectra as obtained from observations of the kinetic Sunyaev-Zeldovich effect for cosmological models with scale-dependent growth arising in the context of ultra-light axions (ULAs). Such scalar particles with masses in the range $10^{-33} < m_a < 10^{-20}$ eV are motivated in string theory and were originally proposed to solve the CP violation problem. After $m_a \geq 3H$ the axion field oscillates rapidly and the effective equation of state is $w \approx 0$, thus the ULA number density approximately dilutes with matter. The oscillatory nature of the axion field gives rise to a scale-dependent perturbation sound speed, leading perturbations on small scales to oscillate rather than grow, suppressing the growth of structure. We present numerical calculations showing how the modifications to the growth of structure as a function of time and scale affect mean pairwise velocity spectra in the presence of ULAs and forecast the ability of probing such cosmological models with upcoming observations.

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