Astrophysics > Cosmology and Extragalactic Astrophysics

# Luke-warm dark matter: Bose-condensation of ultra-light particles

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We discuss the thermal evolution and Bose condensation of ultra-light scalar particles with Compton wavelength of galactic scales. We find an upper bound of 1.5 K for the dark matter temperature from the WMAP constraints on the amount of hot dark matter for a $\Lambda$CDM model. Agglomerations of these particles can form stable halos and naturally prohibit small scale structure, which may be favored by observations of dark matter distributions near the centers of galaxies. We present numerical as well as approximate analytical solutions of the Friedmann-Klein-Gordon equations and study the cosmological evolution of this scalar field dark matter from the early universe to the era of matter domination. Today, the particles in the ground state mimic presureless matter, while the excited state particles are radiation like.

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