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Ultralight Dark Matter

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Ultralight bosons constitute well motivated dark matter (DM) candidates. The most popular candidates being the axion-like particles (ALPs) with very small masses typically arising in string theory. In this scenario, the uncertainty principle prevents the formation of structures on small scales. Indeed, if DM is made of very light particles, the corresponding number density is so high that the interparticle separation becomes smaller than the Compton wavelength so that a field description of DM would be possible. As a matter of fact, at the background level, massive bosons can be described by coherently oscillating classical fields whose average energy density precisely scales as cold DM. Moreover, the effect on perturbations of the ultralight fields can also be understood easily since the de Broglie wavelength can be of astrophysical size. It implies that it is not possible to localize the DM particle on scales smaller than the de Broglie and structure formation is suppressed on those small scales. We will review these ideas and the main phenomenology of scalar, vector and tensor ultralight DM.

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