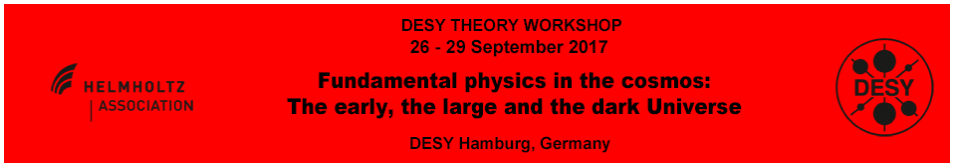

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The ALP miracle: unified inflaton and dark matter

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We propose a scenario where both inflation and dark matter are described by a single axion-like particle (ALP) in a unified manner. In a class of the minimal axion hilltop inflation, the effective masses at the maximum and minimum of the potential have equal magnitude but opposite sign, so that the ALP inflaton is light both during inflation and in the true vacuum. After inflation, most of the ALPs decay and evaporate into plasma through a coupling to photons, and the remaining ones become dark matter. We find that the observed CMB and matter power spectrum as well as the dark matter abundance point to an ALP of mass mφ = O(0.01)-O(0.1)eV and the axion-photon coupling gφγγ = O(10^{−11})GeV^{−1}: the ALP miracle. The suggested parameter region is within the reach of the next generation axion helioscope, IAXO, and high-intensity laser experiments in the future. Furthermore, thermalized ALPs contribute to hot dark matter and its abundance is given in terms of the effective number of extra neutrino species, ΔNeff ⊠ 0.03, which can be tested by the future CMB and BAO observations.

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