Abstract Submitted
for the APR16 Meeting of
The American Physical Society

Complex Scalar Field Dark Matter and its Imprint on the Gravitational Wave Background from Inflation BOHUA LI, PAUL SHAPIRO, Univ of Texas, Austin, TANJA RINDLER-DALLER, University of Michigan/University of Vienna — We consider an alternative CDM to WIMP dark matter, ultralight bosons (m$>\sim 10^{-22}$eV) of a complex scalar field (SFDM), whose number per unit comoving volume is conserved after particle production during standard reheating (w=0). In a ΛSFDM universe, SFDM starts relativistic, evolving from stiff (w=1) to radiationlike (w=1/3), before becoming nonrelativistic and CDM-like at late times (w=0). Thus, before the familiar radiation-dominated phase, there is an earlier phase of stiff-matter-domination. The transitions between these phases, determined by SFDM particle mass and self-interaction coupling strength, are constrained by cosmological observables, particularly $N_{\rm eff}$, the effective number of neutrino species during BBN, the redshift of matter-radiation equality, and tensor fluctuations from inflation, which imprint CMB B-modes. Tensor modes that reenter the horizon during or before the stiff phase contribute an energy density as gravitational waves which is amplified by the stiff phase, increasing the expansion rate of the radiation-dominated era. These effects yield constraints on SFDM parameters and make detection of these GWs today possible at high frequencies by laser interferometry, for currently allowed tensor-to-scalar ratio r and reheat temperature.

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Date submitted: 07 Jan 2016 Electronic form version 1.4