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Cosmology and Structure Formation with Scalar Field Dark Matter[1] TANJA RINDLER-DALLER, BOHUA LI, PAUL R. SHAPIRO, Department of Astronomy, The University of Texas at Austin — The exploration of the nature of the cosmological dark matter is an ongoing hot topic in modern cosmology and particle physics. Suggested candidates include ultra-light particles which are described by a real or complex scalar field. Previous literature has revealed the richness of this candidate in terms of its power to explain astrophysical and cosmological observations, from the background cosmological evolution to galactic rotation curves. However, a lot of research remains to be done to find out which parts of the parameter space of this kind of dark matter is able to explain observations on all scales consistently. In this talk, we will present our current and ongoing work on the study of complex scalar field dark matter (SFDM). We find that this SFDM underwent three distinctive states in the early Universe, a scalar-field dominated, a radiation-dominated and a matter-dominated phase. The timing and longevity of each phase places important first constraints on the parameters of the model. For this SFDM model, we revisit classical problems of structure formation theory, like the tophat collapse, the problem of virial shocks, and the cosmological infall problem for an isolated halo, in order to find viable model parameters which match the constraints from cosmology.

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