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Nonlinear Dynamics from Early Dark Energy ERICKA FLORIO, MARY GERHARDINGER, TOM GIBLIN, Kenyon College — The Hubble tension, one of the foremost problems in contemporary cosmology, describes the disparity between two independent ways of measuring the current expansion rate of the Universe, called the Hubble constant. The Hubble tension now stands at 4.2σ, which is a strong indicator of unknown physics. The Early Dark Energy (EDE) field is a scalar field which would have begun to oscillate around matter-radiation equality and would have decayed away quickly afterwards, giving the expansion of the Universe a "boost" at that time which might resolve the Hubble tension (Poulin et al. 2019). The EDE field also displays nonlinear behavior as it decays, behavior which could lead to possible predictions of the EDE theory. However, since the EDE field has so far only been studied using linear analysis, this behavior is not well understood. We are simulating the Universe with EDE added in using GABE, a 3+1-d code which numerically simulates an expanding Universe alongside scalar fields and fluids in the presence of local gravity. It is specifically designed to study nonlinear dynamics. With these simulations, we can determine whether the nonlinear behavior of the EDE field would produce observable consequences, which could then be searched for using next-generation CMB telescope.

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