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The Hubble Tension and Early Dark Energy: Studying Nonlinear Instabilities[1] MARY GERHARDINGER, ERICKA FLORIO, JOHN GIBLIN , Kenyon Coll — One of the emerging problems within cosmology today is the tension between separate measurements of the Hubble constant (H_0), the rate of the expansion of the Universe today. This discrepancy could be due either to systematic errors in measurements or an incompleteness in the Lambda-CDM model of Cosmology. In this work, we assume the latter and investigate a possible solution to this tension by introducing a scalar field, called Early Dark Energy (EDE). EDE turns on around matter-radiation equality, coherently oscillates, and changes the expansion of the universe (Poulin et al 2018). In order to affect only one early-time measurement of H0, it also needs to dilute away quickly which is achieved through nonlinear dynamics. Using only linear analysis, EDE has been shown to solve the Hubble Tension, however nonlinear physics is present which should additionally have observational consequences. Hence, we study the dynamics of this field using a code entitled GABE which numerically evolves scalar fields and fluids in an expanding universe with local gravity. Our goal is to simulate a universe with EDE present in order to make observational predictions about what our Universe should look like today if it had EDE in it.

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