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Numerical Simulations of Oscillatons: Excited States in Spherical Symmetry and Ground State Evolutions in 3D JAYASHREE BALAKRISHNA, Harris-Stowe State University, RUXANDRA BONDARESCU, Cornell University, GREGORY DAUES, NCSA, MIHAI BONDARESCU, AEI — Oscillatons are nonsingular solutions of the Einstein-Klein-Gordon equations represented by periodic metric and real field. Using a 1D code we find that spherically symmetric S-branch excited state oscillatons are inherently unstable under radial perturbations: they either migrate to the ground state or collapse to black holes. Similar to boson stars higher excited state oscillatons cascade through intermediate excited states during their migration to the ground state. Ground state oscillatons are then studied with a 3D numerical relativity code based on the Cactus Computational Toolkit. Finding the appropriate gauge condition for the dynamic oscillatons is challenging. Slicing conditions are explored and a customized gauge condition is implemented. The behavior of these stars under small nonradial perturbations is studied and gravitational waveforms are extracted. The gravitational waves damp on a short timescale, enabling us to obtain the complete waveform. This work is a starting point for the study of real scalar field systems in 3D.

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