Formation and growth of solitons in nonminimally gravitating dark matter

The presence of solitons is a generic prediction in ultralight dark matter models. We investigate their formation and growth, along with the surrounding miniclusters, through 3+1-dimensional simulations. For the first time, we include fully dynamical nonminimal couplings of dark matter to gravity, which modify the mass-radius relation of solitons. Our results show that solitons can form dynamically via gravitational condensation. We also demonstrate that solitons can become unstable and collapse when their densities reach critical values, irrespective of whether the nonminimal couplings are attractive or repulsive. This instability could impact the distribution and phenomenology of solitons in the present-day universe.

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