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Examining the Viability of Phantom Dark Energy KEVIN LUDWICK, LaGrange College — In the standard cosmological framework of the 0th-order FLRW metric and the use of perfect fluids in the stress-energy tensor, dark energy with an equation-of-state parameter $w < -1$ (known as phantom dark energy) implies negative kinetic energy and vacuum instability when modeled as a scalar field. However, the accepted values for present-day w from Planck and WMAP9 include a significant range of values less than -1. Staying within the confines of observational constraints and general relativity, for which there is good experimental validation, we consider a few reasonable departures from the standard 0th-order framework in an attempt to see if negative kinetic energy can be avoided in these settings despite an apparent $w < -1$. We consider a more accurate description of the universe through the perturbing of the isotropic and homogeneous FLRW metric and the components of the stress-energy tensor, and we consider dynamic w and primordial isocurvature and adiabatic perturbations. We find that phantom dark energy does not necessarily have negative kinetic energy for all relevant length scales at all times and, by the same token, that quintessence dark energy does not necessarily have positive kinetic energy for all relevant length scales at all times.

Kevin Ludwick
LaGrange College

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