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The Viability of Phantom Dark Energy as a Quantum Field in 1st-Order FLRW Space[1] 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. We consider a more accurate description of the universe through the 1st-order perturbing of the isotropic and homogeneous FLRW metric and the components of the stress-energy tensor and investigate whether a field with an apparent $w < -1$ may still have positive kinetic energy. Treating dark energy as a classical scalar field in this metric, we find that it is not as obvious as one might think that phantom dark energy has negative kinetic energy categorically. Analogously, we find that field models of quintessence dark energy ($w > -1$) do not necessarily have positive kinetic energy categorically. We then investigate the same question treating dark energy as a quantum field in 1st-order FLRW space-time and examining the expectation value of the stress-energy tensor for $w < -1$ using adiabatic expansion.

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