Abstract Submitted
for the APR08 Meeting of
The American Physical Society

Distinguishing Modified Gravity from Dark Energy PHILLIP ZUKIN, EDMUND BERTSCHINGER, MIT — The acceleration of the universe can be explained either through dark energy or through the modification of gravity on large scales. In this paper we investigate modified gravity models and compare their observable predictions with dark energy models. Modifications of general relativity are expected to be scale-independent on super-horizon scales and scale-dependent on sub-horizon scales. For scale-independent modifications, utilizing the conservation of the curvature scalar and a parameterized post-Newtonian formulation of cosmological perturbations, we derive results for large scale structure growth, weak gravitational lensing, and cosmic microwave background anisotropy. For scale-dependent modifications, inspired by recent $f(R)$ theories we introduce a parameterization for the gravitational coupling G and the post-Newtonian parameter γ. These parameterizations provide a convenient formalism for testing general relativity. However, we find that if dark energy is generalized to include both entropy and shear stress perturbations, and the dynamics of dark energy is unknown a priori, then modified gravity cannot in general be distinguished from dark energy using cosmological linear perturbations.

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Date submitted: 11 Jan 2008 Electronic form version 1.4