An instability in the Standard Model of Cosmology Creates the Anomalous Acceleration without Dark Energy

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ABSTRACT: We introduce a new asymptotic ansatz for smooth, spherical perturbations of the Standard Model of Cosmology (SM) which applies during the $p = 0$ epoch, and prove that such perturbations trigger an instability in the SM on the scale of the supernova data. The instability creates a large, central region of uniform under-density which expands faster than the SM, and this accelerated uniform expansion introduces into the SM precisely the same range of corrections to redshift vs luminosity as are produced by the cosmological constant in the theory of Dark Energy. A phase portrait of the instability places the Standard Model (SM) at a classic unstable saddle rest point, and universality is exhibited in the sense that all sufficiently small perturbations evolve to a nearby stable rest point corresponding to Minkowski space. We then prove that this instability is triggered by a one parameter family of self-similar waves from the radiation epoch $p = \frac{c^2}{3} \rho$ when the pressure drops to $p = 0$. The authors previously proposed this family as possible time-asymptotic wave patterns for perturbations of the SM at the end of the radiation epoch. Using numerical simulations, we calculate the unique wave in the family that accounts for the same values of the Hubble constant and quadratic correction to redshift vs luminosity as in a universe with seventy percent Dark Energy, $\Omega_\Lambda \approx .7$. A numerical simulation of the third order correction associated with that unique wave establishes a testable prediction that distinguishes this theory from the theory of Dark Energy. This explanation for the anomalous acceleration, based on instabilities in the SM together with simple wave perturbations from the radiation epoch that trigger them, provides perhaps the simplest mathematical explanation for the anomalous acceleration of the galaxies that does not invoke Dark Energy. (Joint work with Joel Smoller and Zeke Vogler.)