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Varying Physical Constants from Astrometric and Cosmological Analysis

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We have developed a cosmological model by allowing the speed of light c, gravitational constant G and cosmological constant Λ in the Einstein filed equation to vary in time, and solved them for Robertson-Walker metric. Assuming the universe is flat and matter dominant at present, we obtain a simple model that can fit the supernovae 1a data with a single parameter almost as well as the standard ΛCDM model with two parameters, and has the predictive capability superior to the latter. The model, together with the null results for the variation of G from the analysis of lunar laser ranging data determines that at the current time G and c both *increase* as dG/dt = 5.4GH and dc/dt = 1.8cH with H as the Hubble parameter, and Λ *decreases* as dΛ/dt = -1.2ΛH. This variation of G and c is all what is needed to account for the Pioneer anomaly, the anomalous secular increase of the Moon eccentricity, and the anomalous secular increase of the astronomical unit. We also show that the Planck's constant ħ increases as dħ/dt = 1.8ħH and the ratio D of any Hubble unit to the corresponding Planck units increases as dD/dt = 1.5DH. We have shown that it is essential to consider the variation of *all* the physical constants that may be involved directly or indirectly in a measurement of expression rather than only the one whose variation is being considered. The impact of these evolutionary physical constants on the standard model is discussed.

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