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Is a Fundamental "Constant" Changing in Space/Time? LOUISE RIOFRIO, Oceaneering Space Systems — Exploration of the Moon and Mars may yield benefits for physics. Geology and paleontology show that early Earth and Mars had conditions for liquid water and possibly life nearly 3.5 Gyr ago. According to standard models, solar luminosity was only 75% of today's value. Earth and Mars would have been frozen solid. Models must infer an extremely high concentration of gases such as CH4 or CO2 simultaneously heating both planets. Research on variability of fundamental constants is highly recommended in the Science Vision Document, in the ESA-ESO Working Group (WG) report on Fundamental Cosmology and is one of the science cases considered by the ESO WG on ELT. Since the sun turns fuel to energy according to $E = mc^2$ an expanding cosmology where c is related to time would provide nearly constant solar luminosity. The Lunar Laser Ranging Experiment from 1969 measures the Moon's recession at precisely 3.82 cm/yr, anomalously high. Geological evidence states that average recession is only 2.9 $\pm$ 0.6 cm/yr. If c slows according to $GM = tc^3$, that would precisely account for the discrepancy. The "most profound mystery" of Type Ia supernovae may also be explained. Supernova redhsifts appear to accelerate, leading to speculation about dark energies. A theory's prediction provides a precise fit to observations. Corroborating data from the Moon and Mars may indicate a "c change" in physics.

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