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Bell Tests On a Larger Scale and General Relativity Effects on Hyperentanglement INCI ANALI, Harvey Mudd College, NGAN NGUYEN, Pitzer College, JASON GALLICCHIO, Harvey Mudd College, NASA JPL DEEP SPACE QUANTUM LINK TEAM — Entanglement is measured in a Bell Test, which puts a bound on the correlation between the states of two particles under a local-realist theory. We propose a Bell Test with a source halfway between the Earth and the Moon that would send a pair of entangled photons to a polarizer on the Moon and a polarizer on the Earth, the settings of which humans would adjust. At this large scale, humans would be space-like separated, meaning the decision on one side could not affect the photons measurement outcome on the other side. Moreover, humans could be given sufficient time to be presented with a choice, make a decision, and turn that decision into a polarizer setting after the entangled photons were sent. Taking Bell Tests to this large scale might better validate non-locality and perhaps, combined with the effects of relativity, reveal something new. Furthermore, we also propose generating and testing hyperentangled (entangled in both polarization and time) photons via an optical scheme in the Earth-LEO satellite scale. Hyperentanglement has never been brought to this large scale before, nor have the effects of relativity on it been tested. Our calculations show that the effect of general relativity on these hyperentangled particles is only non-negligible in the time-bin entanglement.

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