Contribution ID: **145** Type: **oral presentation**

Tests of Lorentz Invariance Violation with Gamma-rays

Friday, 16 August 2013 08:45 (24 minutes)

Special and general relativity extended our understanding of the concepts of space and time, two of the most basic topics of investigation of modern physics. However, quantum theory has shown that there is more to learn regarding these concepts. Considerations of how to combine the concepts of quantum mechanics and gravity (quantum gravity) indicate that the Planck scale is a "natural scale" at which the physics of space-time predicted by relativity theory breaks down and thus requires modification, or a new paradigm. Gamma-ray observations of extraterrestial objects like gamma-ray bursts, active galactic nuclei, or pulsars with VERITAS, CTA, or HAWC could reveal effects that result from such a modification. An example that we will discuss in the context of ground based gamma-ray observatories is an energy dependent dispersion relation of the speed of light resulting from a violation of Lorentz invariance.

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Session Classification: Cosmic Frontier

Track Classification: Cosmic Frontier