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Searching for Lorentz Violation in Astrophysics SEIICHIROU YOKOO, ROLAND ALLEN, Texas A&M University — Astrophysical, terrestrial, and space-based searches for Lorentz violation are briefly reviewed. Such searches are motivated by the fact that all superunified theories (and other theories that attempt to include quantum gravity) have some potential for observable violations of Lorentz invariance. We also review some new predictions of a specific Lorentz-violating theory: If a fundamental energy in this theory lies below the usual GZK cutoff, the cutoff is shifted to infinite energy; i.e., it no longer exists. On the other hand, if the fundamental energy lies above the GZK cutoff, there is a high-energy branch of the fermion dispersion relation which provides an alternative mechanism for super-GZK cosmic-ray protons. We also consider the dark matter problem from a new perspective: In Lorentz-violating supergravity, sfermions have spin 1/2 and other unusual properties. If the dark matter consists of such particles, there is a natural explanation for the apparent absence of cusps and other small scale structure: The Lorentz-violating dark matter is cold because of the large particle mass, but still moves at nearly the speed of light. Although the R-parity of a sfermion, gaugino, or gravitino is +1 in the present theory, these particles have an "S-parity" which implies that the LSP is stable and that they are produced in pairs. On the other hand, they can be clearly distinguished from the superpartners of standard supersymmetry by their highly unconventional properties.

Roland Allen
Texas A&M University

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