

Physics Division Seminar

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Tests of Lorentz Invariance at the Sudbury Neutrino Observatory

Host: Paul Reimer

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Lorentz symmetry is among the most fundamental assumptions in physics. Experimental tests that this symmetry is respected in systems of all types are therefore critically important. The neutrino sector is of particular interest to theorists in this area because the small mass of the neutrino may allow it to be used as a particularly sensitive probe of new physics. However, few experimental tests have been carried out in this area. In this seminar, I will report on a new analysis searching for possible violations of Lorentz symmetry in seven years of data from the Sudbury Neutrino Observatory, a kiloton-scale heavy water Cherenkov detector. Such violations would appear as one of eight possible signal types in the detector: six seasonal variations in the solar electron neutrino survival probability with different energy and time dependencies, and two shape changes to the oscillated energy spectrum. No evidence for such signals was observed, and limits on the size of these effects are established in the framework of the Standard Model Extension, including 40 limits on previously unconstrained operators and improved limits on 15 additional parameters. Limits on all leading-order operators in the neutrino sector are now available for the first time.