3:30 pm • Friday September 26, 2014 • 2241 Chamberlin Hall • Coffee at 4:30 pm

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Hunting for Topological Dark Matter with Atomic Clocks

Department of Physics Colloquium

WISCONSIN

Atomic clocks are arguably the most accurate scientific instruments ever build. Modern clocks are astonishing timepieces guaranteed to keep time within a second over the age of the Universe. Attaining this accuracy requires that the quantum oscillator be well protected from environmental noise and perturbations well controlled and characterized. This opens intriguing prospects of using clocks to study subtle effects, and it is natural to ask if such accuracy can be harnessed for dark matter searches.

The cosmological applications of atomic clocks so far have been limited to searches of the uniform-in-time drift of fundamental constants. We point out that a transient in time change of fundamental constants can be induced by dark matter objects that have large spatial extent, and are built from light non-Standard Model fields. The stability of this type of dark matter can be dictated by the topological reasons. We point out that correlated networks of atomic clocks, such as atomic clocks onboard satellites of the GPS constellation, can be used as a powerful tool to search for the topological defect dark matter. In other words, one could envision using GPS as a 50,000 km-aperture topological dark-matter detector.

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