



Old Dominion University

Department of Physics

Colloquium

Tuesday, April 21, 2015

"Hunting for Dark Matter with GPS and Atomic Clocks"

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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 (translating into clocks being sped up or slowed down) 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 argue 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 dark-matter detector.

Details: A. Derevianko and M. Pospelov, Nature Phys. 10, 933 (2014)

Presentation: **OCNPS 200 @ 3:00 pm**
Refreshments: **OCNPS Atrium @ 2:30 pm**

All interested persons are cordially invited to attend.