Abstract Submitted
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Searching for Dark Matter and Exotic Physics with Atomic Clocks and the GPS Constellation[1] BENJAMIN ROBERTS, GEOFFREY BLEWITT, CONNER DAILEY, Univ of Nevada - Reno, MAXIM POSPELOV, University of Victoria, BC, ALEX ROLLINGS, Univ of Nevada - Reno, JEFF SHERMAN, NIST, Boulder, WYATT WILLIAMS, ANDREI DEREVIANKO, Univ of Nevada - Reno, GPS.DM COLLABORATION[2] — Cosmological observations indicate that dark matter (DM) constitutes 85% of all matter in the Universe, yet conclusive evidence for DM in terrestrial experiments remains elusive. One of the possibilities is that DM can be composed from ultralight quantum fields whose self-interactions lead to the formation of DM objects in the form of stable topological defects. As the Earth moves through the halo of DM objects, interactions with such DM clumps could lead to measurable variations in GPS signals which propagate through the satellite constellation at galactic velocities. We use the network of atomic clocks onboard GPS satellites as a 50000 km aperture DM detector. By mining over 16yr of archival GPS data, we find no evidence for topological defects in the form of domain walls at our current sensitivity, which enables us to improve the present limits on certain DM–ordinary matter coupling strengths by up to six orders of magnitude.

A. Derevianko and M. Pospelov, Nat. Phys. 10, 933 (2014)

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