Abstract Submitted
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Searching for Dark Matter and Exotic Physics with Atomic Clocks and the GPS Constellation[1] CONNER DAILEY, BENJAMIN ROBERTS, GEOFFREY BLEWITT, ANDREI DEREVIANKO, University of Nevada, Reno, GPS.DM COLLABORATION — Dark matter (DM) constitutes 85% of all matter in the Universe, yet conclusive evidence for DM in terrestrial experiments remains elusive. One possibility is that DM is 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 that propagate through the satellite constellation at galactic velocities. We use the network of GPS atomic clocks as a 50,000-km aperture DM detector [1]. Recently, we (the GPS.DM collaboration) mined over 16 yr of archival GPS data, and found no evidence for DM in the form of domain walls, which enabled us to improve present limits on certain DM–ordinary matter coupling strengths by up to 6 orders of magnitude [2]. Here we highlight recent advances made in the GPS.DM collaboration, including (1) a method based on Bayesian analysis that allows us to increase the sensitivity by 2 orders of magnitude, and allows the search for more general DM geometries, e.g. monopoles and strings; (2) our new capability to generate 1-s GPS atomic clock data with precision <0.1 ns; and (3) new developments in signal detection algorithms.

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Geoffrey Blewitt
University of Nevada, Reno

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