Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Towards the Gravitational Detection of Dark Matter on Earth[1]
SOHITRI GHOSH, University of Maryland, DANIEL CARNEY, University of Maryland and Fermilab, GORDAN KRNJAIC, Fermilab, PETER SHAWHAN, University of Maryland, JACOB TAYLOR, University of Maryland and NIST — Current experimental efforts to see particulate dark matter rely upon the assumption of a non-gravitational interaction with visible matter. Here, we propose an approach for the direct detection of dark matter through its gravitational coupling to terrestrial devices. Relying upon advances in mechanical systems and their detection, we propose that an array of high-quality factor, massive mechanical resonators can detect the tiny classical gravitational forces induced by individual dark matter particles passing through the detector. With current technology and relatively standard assumptions about the distribution of dark matter in our galaxy, we estimate that it is possible to measure Planck-scale dark matter particles. With simple improvements to the technology, the sensitivity floor can reach GUT-scale dark matter candidates. We discuss the scientific challenge of building such a device and the potential implications of dark matter models in this mass range.

[1]We acknowledge the funding by NSF for Joint Quantum Institute at University of Maryland.

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Date submitted: 01 Feb 2019 Electronic form version 1.4