Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Tests of gravity using a Strontium atom interferometer over 10 cm to 1 m length scales TEJAS DESHPANDE, JAYAMPATHI KANGARA, JONAH GLICK, KENNETH DEROSE, NATASHA SACHDEVA, YIPING WANG, TIMOTHY KOVACHY, Northwestern University — Studies of fundamental physics, using light-pulse atom interferometers (AIs), have been proposed for performing tests of the equivalence principle, dark matter searches, and gravitational wave detection. Moreover, such AIs enable tabletop tests of quantum mechanics over macroscopic length scales where gravitational curvature is non-negligible. For example, meter-scale quantum superposition has been demonstrated in a 10 m ^{87}Rb atomic fountain [1]. Building on techniques developed in [1], we are constructing a ^{87}Sr gravity gradiometer, with the goal of performing gravitational measurements of well-controlled terrestrial sources. The detector and source(s) in our experimental setup are a stationary 2 m ^{87}Sr AI and high-purity mobile proof mass(es) respectively. The advantages of this apparatus compared to ^{87}Rb are: (a) lower sensitivity of ^{87}Sr to ambient magnetic fields, (b) compact vacuum system allowing up to 10 cm separation between the proof mass and the AI. In this talk, we will provide an overview the design and progress on implementation of the various sub-systems of our ^{87}Sr AI such as lasers, atom sources, ultrahigh vacuum setup, and the atom imaging scheme. Kovachy et al. Nature 528, 530(2015); Asenbaum et al. PRL 118, 183602 (2017).

Tejas Deshpande
Northwestern University

Date submitted: 28 Jan 2020

Electronic form version 1.4