

Progress towards non-destructive measurements of Bloch oscillations as a force sensor to constrain dark matter theories

Schlupf Chandler, Hamilton Paul, Niederriter Robert, Rodriguez Kayla
Univ of California - Los Angeles

We are developing an apparatus to search for physics beyond the Standard Model, such as ultralight dark matter [1]. This system will measure forces on laser-cooled ytterbium atoms by observing Bloch oscillations of the atoms coupled to light in an optical lattice [2]. Non-destructive measurement techniques permit continuous measurements in a small volume with long coherence times providing sensitivity to time-varying forces, such as those expected from axion-like dark matter candidates. We present progress towards these non-destructive measurements of Bloch oscillations in our optical cavity.

References

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- [2] B. Prasanna Venkatesh, M. Trupke, E. A. Hinds, and D. H. J. O'Dell, "Atomic Bloch-Zener oscillations for sensitive force measurements in a cavity", *Physical Review A* 80, 063834 (2009).