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Measuring the fine structure constant with Bragg diffraction and Bloch oscillations CHENGHUI YU, BRIAN ESTEY, RICHARD PARKER, JORDAN DUDLEY, HOLGER MLLER, Univ of California - Berkeley — We have demonstrated a new scheme for atom interferometry based on large-momentum-transfer Bragg beam splitters and Bloch oscillations [1]. In this new scheme, we have achieved a resolution of $\delta\alpha/\alpha$=0.25ppb in the fine structure constant measurement, which gives up to 4.4 million radians of phase difference between freely evolving matter waves. We have suppressed many systematic effects known in most atom interferometers with Raman beam splitters such as light shift, Zeeman effect shift as well as vibration. We have also simulated multi-atom Bragg diffraction to understand sub-ppb systematic effects, and implemented spatial filtering to further suppress systematic effects. We present our recent progress toward a measurement of the fine structure constant, which will provide a stringent test of the standard model of particle physics. [1] Estey et al., PRL 115, 083002 (2015).

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