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Atom optics for excited-band Bloch oscillations and vertical contrast interferometry[1] DANIEL GOCHNAUER, TAHIYAT RAHMAN, ANNA WIRTH, KATHERINE MCALPINE, SUBHADEEP GUPTA, University of Washington — Our ytterbium (Yb) Bose-Einstein condensate (BEC) contrast interferometer (CI) operates with standing-wave light pulses and is designed to make a precision measurement of the fine structure constant, α, via a photon recoil measurement. We previously demonstrated a method to determine atomic band structure in an optical lattice through the analysis of the consequent lattice-induced phase shifts in our CI [1], which has led to a technique for the minimization of such phase shifts through particular usage of Bloch oscillations (BOs) in excited bands of an optical lattice [2]. We will report on the application of this method to demonstrate interferometry with up to $40\hbar k$ momenta supplied by BOs and also discuss extensions of this technique to larger momentum transfer and adaptations towards metrological applications of atom interferometry such as a measurement of α. To this end, we will also report on our progress towards a new vertically oriented CI to increase the interferometer time and thus sensitivity for such applications. [1] D. Gochnauer et al, Phys Rev A 100, 043611 (2019). [2] K. McAlpine et al, arXiv:1912.08902

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