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Toward a sub-ppb measurement of α using atom interferometry with Bose-Einstein condensates[1] BEN PLOTKIN-SWING, ALAN JAMISON, NATHAN KUTZ, SUBHADEEP GUPTA, University of Washington — We are preparing to perform an interferometric measurement of the recoil frequency of ytterbium atoms in a Bose-Einstein condensate (BEC). Such a measurement will yield a sub part-per-billion determination of the fine structure constant, α, and allow for stringent tests of QED. We present the design of our symmetric three-path BEC contrast interferometer, which is favorable for a precision measurement due to its insensitivity to vibrations and ac Stark shifts, and because the recoil phase varies quadratically with additional recoils. We choose Yb BECs as our atom source for its insensitivity to magnetic fields and its coherence properties. We discuss various possible sources of systematic error to our experiment, and our planned route to achieve sub-ppb precision. Mean-field effects are the largest potential source of systematic error. We present theoretical work that shows our ability to model these effects and subtract them from our final result. We report on current experimental progress, including diffraction of a Yb BEC using standing wave optical pulses — short pulses for momentum-state beam-splitting and long pulses as mirrors — as well as progress towards additional acceleration pulses in order to boost the recoil phase and achieve the desired precision.

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