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Offset simultaneous conjugate interferometers and Bloch beamsplitters for measuring the fine structure constant ZACHARY PAGEL, WEICHENG ZHONG, RICHARD PARKER, HOLGER MUELLER, University of California, Berkeley — Precision measurement of the fine-structure constant (α) provides one of the most stringent tests of quantum electrodynamics and the standard model of physics. Last year, our group published a measurement of α with 0.2 ppb uncertainty, and placed constraints on classes of beyond the standard model particles. We have since studied techniques that will help improve sensitivity and systematics in our next-generation measurement of α . First, we demonstrate an offset simultaneous conjugate interferometer (OSCI) as a method to cancel phase shifts resulting from the derivatives of forces. OSCI is primarily used to cancel the gravity gradient phase shift in our experiment, the largest correction made to our measured value of α . We also numerically and experimentally study Bloch beamsplitters, a novel beamsplitter technique for atoms which is ideally suited for large momentum transfer (LMT) interferometers. Experimentally, the Bloch beamsplitter technique is shown to be coherent and the LMT potential of the technique is demonstrated.

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