Abstract Submitted
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Current Work to Improve Precision in Measurements of Helium Fine Structure[1] NIMA HASSAN REZAEIAN, ALI KHADEMIAN, DAVID SHINER, University of North Texas — Measurements on the fine structure of the 2P state of the helium atom show good agreement, 0.22(30) kHz, between the most recent theory (complete $m\alpha^7$ evaluation with 0.02 kHz numerical uncertainty) and experiment. Among other things, this result could be used to give a value for the fine structure constant alpha with a 5 ppb uncertainty. However, some of the uncalculated $m\alpha^8$ terms (those with large Z scaling), might contribute as much as 1.2 kHz, limiting the precision and thus calling for further theoretical work. For application to a precision alpha determination, an order of magnitude experimental improvement is desirable, given the electron g factor (0.4 ppb) and photon recoil (0.7 ppb) uncertainties. To this end we are currently addressing a major source of experimental uncertainty in our previous measurements by incorporating a convenient and reliable tunable laser frequency selector.[2] An approach using a fiber grating and fiber circulator will be discussed.

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[2]Marc Smiciklas and David Shiner, Phys. Rev. Lett. 105, 123001 (2010)

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