Abstract Submitted
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Ongoing Work to Improve Precision Laser Spectroscopy of Helium Fine Structure.[1] GARNET CAMERON, RONNIE CURREY, KHADIJAH ALNASSER, COREY NOOK, ALI KHADEMIAN, DAVID SHINER, Univ of North Texas — Spectroscopy of the 2P triplet levels of helium provides a nice proving ground for various precision experimental techniques. It also provides a sensitive test of atomic theory, quantum electrodynamics and, with the isotope shift determination of the nuclear size, a test of nuclear few-body theory. It can also provide, with improvements, an important input to the value of the fine structure constant, α. Several improvements to our previous experiments are ongoing, including making the study of potential systematic errors more convenient by increasing the count rate. A straight forward increase results from reducing the source-detector separation. This is accomplished by replacing the static high voltage E-field quench plates used for the elimination of the 2S singlet background, with a more reliable and convenient laser to induce the 2S to 2P singlet resonant quenching transition at 2059 nm. We discuss the theory and performance of the 2059 nm cladding-pumped Tm fiber laser we use. The in-house fabricated Tm fiber laser has required several design iterations. Additional 1083 nm fiber lasers are being implemented to improve signal via pumping to a single m_s level (+1 or -1). As emphasized by Hessels and co-workers [1] for these laser transitions, non-resonant transition amplitudes often make contributions that must be included in the data analysis at current and future levels of precision. We discuss this and experimental tests of its proper inclusion. 1. A. Marsman, M. Horbatsch, and E.A. Hessels, Phys. Rev. A 86, 040501 (2012).

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