Abstract Submitted
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Few-Nucleon Charge Radii and a Precision Isotope Shift Measurement in Helium[1] NIMA HASSAN REZAEIAN, DAVID SHINER, University of North Texas — Precision atomic theory and experiment provide a valuable method to determine few nucleon charge radii, complementing the more direct scattering approaches, and providing sensitive tests of few-body nuclear theory. Some puzzles with respect to this method exist, particularly in the muonic and electronic measurements of the proton radius, and as well with respect to measurements of nuclear size in helium. We perform precision measurements of the isotope shift of the 2^3S -2^3P transitions in ^3He and ^4He. A tunable laser frequency discriminator and electro-optic modulation technique give precise frequency and intensity control. We select (t_s <50 ms) and stabilize the intensity of the required sideband and eliminate the unused sidebands ($\leq 10^{\neg 5}$). The technique uses a MEMS fiber switch (t_s = 10 ms) and several temperature stabilized narrow band (3 GHz) fiber gratings. A fiber based optical circulator and amplifier provide the desired isolation and net gain for the selected frequency. A beam with both species of helium is achieved using a custom fiber laser for simultaneous optical pumping. A servo-controlled retro-reflected laser beam eliminates Doppler effects. Careful detection design and software control allows for unbiased data collection. Current results will be discussed.

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