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Two photon optical Ramsey spectroscopy of positronium and muonium

Wednesday 12 June 2024 18:00 (2 hours)

As the lightest known atom, Positronium (Ps) presents a significant challenge for high-precision spectroscopy. Time-of-flight broadening and second-order Doppler shifts are the main factors affecting the accuracy in the measurement of the 1S-2S transition. We propose using two photon optical Ramsey spectroscopy. Our detailed simulation shows that with this method, the line width of the 1S-2S transition in our experiment could be reduced from 100 MHz to the natural line width at the 1 MHz level. Combined with our technique to measure the 2S Ps velocity in order to correct for the second-order Doppler shift atom by atom, this opens up great prospects for improving the current best measurement by more than an order of magnitude. We will also discuss the application of this method to Muonium spectroscopy which should allow to reach sub-kHz resolution.

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