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2S-8S/D spectroscopy with a cryogenic hydrogen beam[1]

DYLAN YOST, Colorado State University - Department of Physics

Hydrogen is the most abundant element in the universe, and the most important element for the development of modern physics – an attribute that can be traced back to its simplicity as an effective two-body system. Currently, precision hydrogen spectroscopy remains an exciting field which determines the Rydberg constant and stringently tests QED. In addition, spectroscopy of the 2S-8S/D transitions, in conjunction with the precisely measured 1S-2S transition, can be used to determine the proton charge radius. However, previous measurements of these transitions do not agree with more recent determinations of the proton radius in both hydrogen and muonic hydrogen spectroscopy. In this talk, we will present preliminary spectroscopy of the 2S-8S/D transitions with a new experimental setup. A 5 K atomic hydrogen beam is optically excited to the 2S state via two-photon absorption. The 2S-8S/D transitions are then excited by two-photon absorption at 778 nm. This method could result in a more precise measurement due to the reduction of velocity effects, and greater metastable flux.

In Collaboration with: Adam Brandt, Samuel Cooper, Cory Rasor, Jordan Smith, Zak Burkley, Colorado State University

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