

## New Scientific Opportunities with the TRIUMF ARIEL e-linac



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### Proton Radius: A Puzzle or a Solution!?

*Thursday, May 26, 2022 3:30 PM (30 minutes)*

The proton radius puzzle is known as the discrepancy of the proton radius, obtained from muonic hydrogen spectroscopy (about 0.84fm), and the proton radius obtained from (ordinary) hydrogen spectroscopy by the Paris group, who measured a number of transitions in atomic hydrogen, involving highly excited states (which led to a radius of 0.88fm). Recently, a number of measurements of hydrogen transitions by the Munich (Garching) groups (2S-4P), by the spectroscopy group at the University of Toronto (2S-2P<sub>1/2</sub>), and by the group at Colorado State University (2S-8D), have led to transition frequency data which is consistent with the smaller proton radius, pointing to a possible, purely experimental, resolution of the proton radius puzzle. In the talk, we will discuss a complete reevaluation of the irreducible two-loop vacuum-polarization correction to muonic hydrogen energy levels. This calculation addresses one of the most challenging contributions relevant for the proton radius puzzle. We also give an overview of the general theoretical status of the theory of the Lamb shift in simple atomic systems. A comparison of the raw data for the Sachs G<sub>E</sub> form factor of the proton, from the PRad and Mainz collaborations, reveals that the situation in regard to scattering experiments might be less clear than currently thought, raising the question whether or not the proton radius puzzle has been conclusively solved, and opening up interesting experimental possibilities at TRIUMF ARIEL.

#### Attendance

#### Contact Email

#### Scheduling Constraints

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