The Precision Frontier: Lepton-Proton Scattering

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Abstract: The nucleon and its structure are the focus of intense study on all energy scales, in both current and upcoming experiments. It is one of the simplest systems in non-perturbative QCD and the accurate description of its properties is a touchstone for theoretical calculations.

Recent precision experiments have provided a wealth of information, but have also illuminated two glaring discrepancies: the proton radius puzzle and the form factor ratio divergence. The former, still unsolved, may have opened the door to discovery of physics beyond the Standard Model, while a solution to the latter seems in reach.

In this talk, I will discuss the Mainz high precision form factor measurement and global form factor analysis, which are corner stones of the radius puzzle; the OLYMPUS experiment, which is poised to give the final confirmation of the solution to the ratio problem; the MUSE experiment, which will provide a missing piece for the proton radius puzzle; and the proposed DarkLight experiment, which will search for physics beyond the Standard Model at the intensity frontier.