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Determination of the Proton's Charge Radius by Simultaneous Measurement of Electron- and Muon-Proton Elastic Scattering with the MUSE Experiment at PSI

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The mean charge radius of the proton has been measured with elastic electron scattering and through spectroscopy of atomic hydrogen with consistent results. Recent results based on spectroscopic measurements of muonic hydrogen, however, have found a notably smaller charge radius with extremely high precision. This difference, known as the Proton Radius Puzzle, raises interesting issues ranging from experimental and methodological issues to physics beyond the Standard Model. To address some of these issues, the MUon proton Scattering Experiment (MUSE) at the Paul Scherrer Institute will measure positive and negative muon, electron and positron elastic scattering from the proton. The experiment will cover a four-momentum-transfer range from 0.002 to 0.08 GeV^2. These data will be used to study possible differences between electron and muon interactions, to measure two-photon exchange effects, and to extract the proton charge radius. An overview of the experiment and its status will be presented.

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MUSE

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