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Diffusion of μp in the hyperfine-splitting experiment at PSI

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Due to the close bond between orbiting muon and nucleus, the energy levels of muonic atoms are highly sensitive to effects of the nuclear structure. In order to study the magnetic structure of the proton, we are preparing a measurement of the ground-state hyperfine splitting in muonic hydrogen (μp) at Paul Scherrer Institute (PSI). In this experiment, μp atoms diffuse through a hydrogen gas cell in order to be excited with an infrared laser. To constrain experimental parameters and predict signal rates for the measurement, we use Monte Carlo simulations of the diffusion process. For this, we have implemented custom physics processes in Geant4 based on differential rates for molecular collisions. This poster provides an introduction to the detection scheme of the hyperfine-splitting experiment and reviews our simulations of μp diffusion in the target.

Primary author: NUBER, Jonas (PSI - Paul Scherrer Institut)

Co-author: COLLABORATION, CREMA

Presenter: NUBER, Jonas (PSI - Paul Scherrer Institut)

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