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Laser-Driven Polarized Deuterium Source

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Polarized light ion beams are essential to the physics program for a future electron-ion collider (EIC), and polarized deuterons have been identified as essential tools to probe the sea quark and gluon distributions in studies of hadronization. Polarized deuterons form an especially unique system for study by providing a combination of quark and nuclear physics, and thus can yield new insights in the understanding of hadron structure that cannot be achieved with other polarized nuclei. Both the Jefferson Lab Electron-Ion Collider (JLEIC) and the electron-ion collider at Brookhaven National Lab (eRHIC) machine design concepts have integrated polarized deuteron transport into their designs, but there are currently no operational polarized deuteron beam sources in the United States. A new method for production of neutral polarized atomic deuterium beams is discussed. The method utilizes infrared stimulated Raman adiabatic passage (IR STIRAP) in the production of polarized deuterium halide molecules, from which polarized deuterium atoms can be accessed through photodissociation. The method has the potential to generate neutral polarized atomic deuterium beams with densities that are orders of magnitude greater than that in existing devices.

Summary

Primary author: SY, Amy (JLab)

Presenter: SY, Amy (JLab)

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