

Production and Storage of Polarized H₂, D₂, and HD Molecules

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An atomic beam source (ABS) is producing a nuclear- and electron-polarized beam of hydrogen or deuterium atoms that can be used to feed a polarized storage-cell gas target. In a dedicated apparatus these atoms recombine on the surfaces inside the storage cells to molecules. Depending on the chosen surface material, the nuclear polarization of the atoms is at least partially preserved in the molecules. In recent experiments we ran our ABS with a mixture of hydrogen and deuterium and could polarize both isotopes independently. When those atoms recombine into molecules we produce H₂, D₂ and HD molecules as well. After ionization and acceleration of these molecules we could separate the different ions in a Wienfilter and measure the nuclear polarization of both nucleons with the Lamb-shift polarimeter. Depending on the hyperfine states that are determined by the ABS different spin-isomers of the HD are produced and used for further measurements. In a next step we will try to use a fully magnetized Nickel surface to investigate the influence of the electron polarization on the recombination rate and the nuclear polarization of the molecules. On a long term scale it is foreseen to freeze out the polarized molecules on a cold surface below 10 K to collect the D₂ or HD gas as polarized ice.

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