Contribution ID: **32** Type: **Talk**

Polarized Molecules: A new Option for Internal Storage-Cell Targets?

Friday 18 September 2015 11:30 (30 minutes)

In the last two decades the intensity of polarized atomic beam sources sticks at about 10^{17} polarized atoms/s. Therefore, even the areal density of internal storage-cell targets for experiments like ANKE/COSY or PAX/COSY could not exceed 10^{14} atoms/cm^2. Even the use of openable storage cells or cooling of the cell walls could not help to overcome this limit. One possible option to increase the figure of merit of experiments with polarized storage-cell targets might be to recombine the polarized atoms into molecules without polarization losses. With a dedicated apparatus the recombination process of polarized hydrogen and deuterium atoms on different surface materials was investigated in a temperature range from 40 to 120 K and at magnetic fields up to 1 T. Finally, we found a material that preserves the nuclear polarization during the recombination process and allows the production of polarized hydrogen and deuterium molecules with a polarization higher than 0.8. Therefore, the target density compared to atomic storage-cell targets can be increased by three different effects:

1.) The walls of the storage cell can be cooled down to 40 K without polarization loss.

2.) At the same temperature the average velocity of the molecules is smaller by a factor $\sqrt{2}$.

3.) The interaction of the molecules with the wall can be used to increase the amount of wall collisions inside the cell.

These measurements are even interesting to learn more about the recombination process itself, the behavior of the nucleon spin during chemical reactions, and the interaction of hydrogen/deuterium molecules with different surface materials. When polarized deuterium molecules can be stored even further, than this kind of „polarized fuel“can help to increase the energy output or to reduce the costs of nuclear-fusion reactors.

Primary author: Dr ENGELS, Ralf (Institut für Kernphysik, Forschungszentrum Jülich, Wilhelm-Johnen-Str. 1, 52428 Jülich, Germany)

Presenter: Dr ENGELS, Ralf (Institut für Kernphysik, Forschungszentrum Jülich, Wilhelm-Johnen-Str. 1, 52428 Jülich, Germany)

Session Classification: Session 15