Contribution ID: **182** Type: **Poster**

Towards Nuclear Spin Polarization of Deuterium - Tritium

The parallel polarization of D and T nuclei should increase the reactivity of the fuel used, both in Magnetic Confinement Fusion (MCF) and Inertial Confinement Fusion (ICF). One has to make sure however, i) that the polarization will survive at high temperature in the MCF and ICF very different plasma conditions, ii) that high polarization rate for useable quantities of material can be reached before injection in the fusion reactors. In this contribution, we shall briefly review the recent projects [1] aiming at the experimental demonstration of the long enough polarization survival in fusion processes as predicted in early papers [2, 3] and some progresses in producing and storing polarized fuel.
For the specific case of ICF, gains predicted by realistic calculations and resulting from 100% polarized fuel are significant [4] and will be advocated. Finally, we shall discuss the possibilities to produce suitable polarizations. In the case of ICF, long polarization relaxation times are not needed which may leave a way for the Dynamic Nuclear Polarization (DNP) of the "ortho"configurations of T2 and D2 short time before implosion, another possible path could be the DT hetero-molecule polarization, by revisiting the early investigated DNP techniques for HD [5] and applying them to the DT case, which is certainly not easy but would provide much longer relaxation times [6]. Recently, the production of hyperpolarized H2 molecules from polarized H atoms in gas-storage cells has been demonstrated [7]. This opens a new path to produce a mixture of polarized D2, DT and T2 fuel suitable for both ICF and MCF.

References
[1] J. P. Didelez and C. Deutsch, Laser and Particle Beams 29, 169
(2011)
[2] R.M. Kulsrud et al., Phys. Rev. Lett. 49, 1248 (1982)
[3] R.M. More, Phys. Rev. Lett. 51, 396 (1983)
[4] M. Temporal et al., Nucl. Fusions 52, 103011 (2012)
[5] J.C. Solem and G.A. Rebka, Phys. Rev. Lett. 21, 19 (1968)
J.C. Solem, Nucl. Inst. and Meth. 117, 477 (1974)
[6] S. Bouchigny and J.P. Didelez, Nucl. Instr. and Meth. A 577, 320
(2007)
[7] R. Engels et al., Phys. Rev. Lett. 115, 113007 (2015)

Primary authors: Dr DEUTSCH, Claude (LPGP Université Paris-Sud (UMR-CNRS 8578), 91405 ORSAY, France); Dr DIDELEZ, Jean-Pierre (IPN CNRS/IN2P3 & Université Paris-Sud (UMR-CNRS 8608), 91406 ORSAY, France)

Presenter: Dr DIDELEZ, Jean-Pierre (IPN CNRS/IN2P3 & Université Paris-Sud (UMR-CNRS 8608), 91406 ORSAY, France)

Track Classification: Application of Nuclear Polarization Techniques to Other Fields