Contribution ID: **87** Type: **Parallel Sessions**

Nuclear Polarization in Laser-induced Relativistic Plasmas

Wednesday, 12 September 2018 17:05 (25 minutes)

Laser-driven particle acceleration has undergone impressive progress in recent years. Nevertheless, one unexplored issue is how the particle spins are influenced by the huge magnetic fields inherently present in the plasmas. In the framework of the JuSPARC (Juelich Short-Pulse Particle and Radiation Center) facility and of the ATHENA consortium, the laser-driven generation of polarized proton and 3He-ion beams in combination with the development of advanced target technologies is being pursued. Another goal of these investigations is to experimentally demonstrate that the nuclear spin alignment in a fusion plasma survives for periods at least comparable to the energy confinement time.

In order to predict the degree of beam polarization from a laser-driven plasma accelerator, particle-in-cell simulations including spin effects have been carried out for the first time. For this purpose, the Thomas-BMT equation, describing the spin precession in electromagnetic fields, has been implemented into the VLPL (Virtual Laser Plasma Lab) code. A crucial result of our simulations is that a target containing pre-polarized hydrogen nuclei is needed for producing highly polarized relativistic proton beams.

For the experimental realization, a polarized HCl gas-jet target is under construction at the Forschungszentrum Juelich where the degree of hydrogen polarization is measured with a Lamb-shift polarimeter. The final experiments, aiming at the first observation of a polarized proton beam from laser-generated plasmas, will be carried out at the 10 PW laser system SULF at SIOM/Shanghai. In parallel we have built a hyper-polarized 3He gas–jet target for experiments at the PHELIX Petawatt Laser Facility, GSI Darmstadt, for measuring the spin-polarization degree of laser-accelerated 3He2+ ions.

Primary author: Prof. BÜSCHER, Markus (Forschungszentrum Jülich/PGI-6 and Heinrich Heine University Düsseldorf)

Co-authors: Prof. LEHRACH, Andreas (FZ Jülich and RWTH Aachen); HÜTZEN, Anna (Forschungszentrum Jülich); Dr ENGIN, Ilhan (Forschungszentrum Jülich); Dr THOMAS, Johannes (Heinrich Heine University Düsseldorf); Dr ENGELS, Ralf (Institut für Kernphysik, Forschungszentrum Jülich)

Presenter: Prof. BÜSCHER, Markus (Forschungszentrum Jülich/PGI-6 and Heinrich Heine University Düsseldorf)

Session Classification: Application of Nuclear Polarization Techniques to Other Fields

Track Classification: Application of Nuclear Polarization Techniques to Other Fields