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Towards experiments with polarized beams and targets at the GSI/FAIR storage rings

Thursday 29 September 2022 09:00 (30 minutes)

The talk will discuss the current efforts to generate and operate spin-polarized ion beams at the GSI/FAIR storage ring facilities, aimed at a new class of experiments in atomic, quantum and fundamental physics with light and heavy highly charged ions and exotic nuclei [1]. To this end, as a first step, we plan to install the polarized atom beam source ANKE, capable of providing polarized electrons and/or polarized protons/deuterons at the ESR storage ring. This target will allow us to perform initial experimental feasibility studies by using the radiative electron capture (REC) process for the transfer of spin-polarized target electrons into heavy bare ions. In this way, we will be able to study in detail the polarization transfer reaction to the ion as well as the polarization build-up in the stored ion beam.
The planned experimental investigations at ESR are intended to be the beginning of a series of experiments whose first goal is the generation of spin-polarized ion beams. To this end, the teams at IKP in Jülich with their expertise with stored polarized particle beams and the AP/SPARC group at GSI with their experience in REC studies for high-Z projectiles and in photon polarization studies for hard X-ray and γ-rays are collaborating. Polarized beams of protons, deuterons, and heavy ions have never been realized at GSI before and represent a new degree of freedom for, in particular, heavy ion storage ring experiments. These studies are especially important for future studies in the field of testing the fundamental symmetries of nature and the search for physics beyond the Standard Model, such as time reversal violation, the search for electric dipole moments, and the search for dark matter particles. Once antiprotons are available at FAIR, polarizing them would present a unique opportunity for the laboratory.
The presentation is intended as an opening talk for the subsequent approximately 1-hour open discussion session with the community. The general goal is to highlight the potential for future studies with polarization degrees of freedom at FAIR, to discuss the sequence of steps to realize the experimental program, and to receive feedback from the experts participating in the workshop.

References:

[1] A. Bondarev, R. Engels, S. Fritzsche, R. Grisenti, A. Gumberidze, V. Hejny, P.-M. Hillenbrand, A. Kacharava, T. Krings, A. Lehrach, M. Lestinsky, Yu. A. Litvinov, B. Lorentz, A. Maiorova, F. Maas, W. Middents, A. Nass, T. Over, P. Pfäfflein, J. Pretz, N. Petridis, J. Ritman, F. Rathmann, S. Schippers, R. Schuch, M. Steck, Th. Stöhlker, U. Spillmann, A. Surzhykov, G. Weber, and B. Zhu, Letter of Intent: Towards experiments with polarized beams and targets at the GSI/FAIR storage rings, available from
http://collaborations.fz-juelich.de/ikp/jedi/public_files/proposals/polatfair(6).pdf

Category

Polarized Targets

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