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Towards the Diagnostic of Spin-Polarized Particle Beams: Application of Compton Polarimeters

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Renate Märtina,b, Roman Bardayc, Joachim Endersc, Yuliya Poltoratskac, Uwe Spillmannb, Andrey Surzhykova,b, Günter Weberd , Vladimir A. Yerokhina,b,e and Thomas Stöhlkera,b,d

a) Physikalisches Institut, University of Heidelberg, Philosophenweg 12, Heidelberg 69120, Germany
b) GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, Darmstadt 64291, Germany
c) Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, Darmstadt 64289, Germany
d) Helmholtz-Institut Jena, Helmholtzweg 4, Jena 07743, Germany
e) Saint-Petersburg State Polytechnical University, 29 Polytechnicheskaya st., St. Petersburg 195251, Russia

X-ray radiation arising in energetic collisions of charged particles is generally known to exhibit distinct polarization features reflecting both the dynamics as well as the atomic structure of the collision system. Moreover, in case of spin-polarized particles the polarization properties of the emitted radiation are significantly altered compared to the case of unpolarized collision partners. For the case of bremsstrahlung this so-called polarization transfer was systematically studied theoretical by Tseng and Pratt [1] already in the 1970s and has recently been revisited by several theoretical and experimental works [2, 3]. These recent studies were mainly initiated by the development of novel Compton polarimeters that allow precise measurements of linear polarization in the hard x-ray regime [4] and by the fact that the polarization transfer opens a route for the diagnosis of spin-polarized particle beams. The latter is of particular importance for experiments at the future FAIR facility, where the use of spin-polarized ion beams is planned [5]. Here, besides the bremsstrahlung process also the radiative recombination [6] and characteristic transitions [7] are discussed as probes for the degree of spin-polarization of the ion beam.
We will present measurements addressing the linear polarization properties of bremsstrahlung emitted in polarized electron-atom collisions. These experiments were performed at the polarized electron source SPIN of the TU Darmstadt [8] and proof the feasibility of this polarimetry technique.

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Primary author: Dr MAERTIN, Renate (University of Heidelberg)

Presenter: Dr MAERTIN, Renate (University of Heidelberg)

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