Contribution ID: **211** Type: **Poster presentation**

Compton Polarimetry on Rayleigh Scattering of Highly Linearly Polarized Hard X-rays

Tuesday, 31 August 2021 19:00 (4 minutes)

Rayleigh scattering refers to the 2nd order QED process where a photon is scattered by a bound electron without a change in the photon energy [1]. For photon energies up to the MeV range it is the dominant contribution to the fundamental photon-matter interaction process of elastic scattering. This process is highly polarization-sensitive, making the analysis of polarization transfer in Rayleigh scattering suitable for a stringent test of the underlying theory [2].
A first experiment where an incident highly linearly polarized hard x-ray beam was used and the degree of linear polarization of both the incident and the scattered radiation was observed was performed in the work of Blumenhagen et al. in 2015 at the synchrotron facility PETRA III at Hamburg [3]. In this experiment the polarization-dependent features of the radiation being Rayleigh scattered within the polarization plane of the incident beam were analyzed. For the measurement of the polarization characteristics of the scattered radiation a prototype 2D sensitive strip detector, which was developed in the framework of the SPARC collaboration for precise and efficient x-ray polarimetry, was used serving as a dedicated Compton polarimeter [4]. Well in accordance with theory a dependence of the degree of linear polarization on the polar scattering angle and the degree of polarization of the initial beam was observed.
In a recent follow-up experiment we performed at the beamline P07 of the synchrotron facility PETRA III at DESY we extended on this previous measurement. For the first time, the polarization-dependent fea-tures of the Rayleigh scattered beam were measured outside the polarization plane of the incident, high-ly linearly polarized hard x-ray beam. For this experiment, the hard x-ray beam delivered by the synchro-tron which was set to a photon energy of 175 keV was scattered on a gold foil target of 1 µm thickness. The scattered radiation was detected by an improved prototype Compton polarimeter [5], also devel-oped in the framework of the SPARC collaboration, which was located under several scattering angles in-side and outside of the polarization plane of the initial beam.
Preliminary results show a strong dependence of the orientation of the polarization vector of the scat-tered beam with respect to the scattering plane on the polar and azimuthal scattering angles outside the polarization plane of the incident beam.

This research has been conducted in the framework of the SPARC collaboration. Financial support by ErUMFSP APPA (BMBF n° 05P19SJFAA) is acknowledged.

[1] P.P. Kane et al., Phys. Rep. 140, 75 (1986)
[2] Strnat et al. Phys. Rev. A 103, 012801 (2021)
[3] K.-H. Blu-menhagen et al., New J. Phys. 18, 103034 (2016)
[4] G. Weber et al., J. Phys.: Conf. Ser. 583, 012041 (2015)
[5] M. Vockert et al., NIM B 408, 313 (2017)

Is this abstract from experiment?

Yes

Name of experiment and experimental site

Is the speaker for that presentation defined?

Yes

Details

Mr. Wilko Middents
Helmholtz Institute Jena, Institute of Optics and Quantum Electronics
Friedrich Schiller University Jena, Germany
https://www.hi-jena.de/en/
https://www.physik.uni-jena.de/en/APIX

Internet talk

Maybe

Primary authors: MIDDENTS, Wilko (Friedrich-Schiller-Universität Jena); WEBER, Günter (Helmholtz-Institute Jena;GSI Helmholtzzentrum für Schwerionenforschung GmbH); SPILLMANN, Uwe (GSI Helmholtzzentrum für Schwerionenforschung GmbH); VOCKERT, Marco (Helmholtz Institute Jena); GUMBERIDZE, Alexandre; PFÄFFLEIN, Philip (GSI Helmholtzzentrum für Schwerionenforschung GmbH;Helmholtz-Institute Jena;Friedrich-Schiller-Universität Jena); VOLOTKA, Andrey (Department of Physics and Engeneering, ITMO University St. Petersburg); SURZHYKOV, Andrey (Fundamentale Physik für Metrologie, Physikalisch-Technische Bundesanstalt Braunschweig); STÖHLKER, Thomas (GSI Helmholtzzentrum für Schwerionenforschung GmbH;Helmholtz-Institute Jena;Friedrich-Schiller-Universität Jena)

Presenter: MIDDENTS, Wilko (Friedrich-Schiller-Universität Jena)

Session Classification: Poster Session