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High Purity X-ray polarimetry @ PETRA III and EU X-FEL

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High purity X-ray polarimetry has become a powerful method at x-ray sources of third and fourth generation as well as innovative laboratory sources. Their application has been extended to nuclear resonant scattering, quantum optics in the x-ray range, spectro-polarimetry at selected absorption edges as well as vacuum quantum electrodynamic. The installation of high purity polarimeter allows users at PETRA III beam line P01 and at EU X-FEL beam line MID to use polarimeters which consist of polarizer and analyzer based on multiple reflection channel cut crystals providing a polarization selection up to 10 orders of magnitude in intensity. The physical limits of polarization purity will be given in the contribution. By selecting perfect or nearly perfect crystals of different atomic numbers one can favor the purity or transmitted intensity. Different crystals such as silicon, germanium, or diamond could yield purities in the range between 10-10 …10-7. The instruments located at the synchrotron and FEL will be described.

Application experiments in the field of quantum optics such as vacuum-assisted generation and control of atomic coherences at x-ray energies, tunable subluminal propagation of narrow-band X-ray pulses, and collective strong coupling of X-rays and nuclei in a nuclear optical lattice will be presented by using nuclear resonant scattering of the 57 Fe isotope.

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