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Novel Reflection High-Energy Positron Diffractometer at NEPOMUC

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The precise knowledge of the surface structure is essential to understand e.g. chemical reactions, optimize catalytic techniques or develop nanoelectronic devices. It has been shown that Total Reflection High-Energy Positron Diffraction (TRHEPD) is an ideal technique to determine the structure of the topmost and the immediate subsurface atomic layer of crystals [1]. In contrast to electrons, which are used in Reflection High-Energy Electron Diffraction (RHEED), positrons are repelled by the crystal potential and exhibit the phenomenon of total reflection for small angles of incidence. For this reason, TRHEPD features outstanding surface sensitivity and thus provides information, which cannot be obtained with conventional techniques such as RHEED or SXRD.

Currently, we set up a new e⁺ diffractometer that will be coupled to the high-intensity positron source NEPOMUC [2]. After commissioning in 2018, first e⁺ beam experiments will be performed on reference samples such as Si(111) and Ge(110) and with various e⁺ energies (10-30keV) to demonstrate the superior features of the new diffractometer. This project is financially supported by the BMBF (funding number 05K16WO7).

[1] I. Mochizuki et al., Phys. Chem. Chem. Phys. 18, 7085 (2016)

[2] C. Hugenschmidt et al., J. Phys. Conf. Ser. 505 012029 (2014)

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