# The new dedicated HAXPES beamline P22 at PETRAIII

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A new X-ray undulator beamline dedicated to HAXPES applications will open for user operation in autumn 2018 at PETRA III (DESY, Hamburg). The X-ray source is a 2m X-ray undulator covering an energy range from 2.4 to 30 keV. The primary $LN_2$-cooled double Si-crystal monochromator comprises remotely interchangeable pairs of Si(111) and (311) crystals. For higher energy resolution requirements, a double channel-cut (4-bounce) post-monochromator with different sets of crystals can be used. In the same uhv vessel, a diamond phase plate is available providing variable circular/linear beam polarization for the study of magnetic materials. Beam focusing is realised by horizontally deflecting mirrors, combining a cylindrical - plane mirror pair for the vertical with a plane elliptical bendable mirror located close to the experiments for the horizontal. The expected minimum spot size at the first instrument position is $<10\times10$ $\mu$m$^2$ providing about $2\times10^{13}$ ph/s (Si(111) at 4-6 keV). Additionally, a 1D Be-lens transfocator can be alternatively used for horizontal focusing down to about $70\times10$ $\mu$m$^2$ on the sample. This new beamline comprehends a unique selection of HAXPES techniques using specialized instruments built and operated in collaboration with external user groups. The main instrument is the established HAXPES setup relocated from PETRA III beamline P09. It provides an optional wide-angle lens for increased transmission and/or angle resolved studies as well as an add-on spin selective detector employing an improved 2D spin filter which is currently being commissioned [2]. The second setup is a HAXPEEM instrument which has been developed and commissioned in the recent years [3] for spectro-microscopy applications utilizing the depth sensitivity in the keV energy range. A third specialized instrument will facilitate in-operando studies of catalytic reactions at industrially relevant conditions and pressures up to 10 bar [4]. As a further development, a novel instrument combining full-field k-microscopy with time-of-flight (ToF) parallel energy recording will be tested at the beamline to measure the 4D spectral function $\rho(E_B,k)$ in the HAXPES regime. This ToF spectrometer makes use of the unique PETRA III timing mode and has already successfully been used recently in the XUV regime [5].

**References**

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