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# New possibilities for Hard X-Ray Photoelectron Spectroscopy at DESY

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A new X-ray undulator beamline dedicated to HAXPES applications is now open for user operation at PETRA III (DESY, Hamburg). The 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. The HAXPEEM instrument for spectromicroscopy applications utilizing the depth sensitivity in the keV energy range. A third instrument facilitates in-operando studies of catalytic reactions at industrially relevant pressures up to 10 bar. 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 $\rho(E_B,\mathrm{k})$ in the HAXPES regime.

The X-ray source is a 2m X-ray undulator covering an energy range from 2.4 to 30 keV while wave length selection is facilitated by $LN_2$-cooled double Si-crystal monochromator with interchangeable Si(111) and (311) crystal pairs. Furthermore, a 4-bounce post-monochromator and a diamond phase plate are available. The expected minimum spot size at the first instrument position is ~10x10 $\mu m^2$ providing about $2x10^{13}$ ph/s (Si(111) at 4-6 keV).

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