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PHELIX - Advance Instrument for Photoemission and Soft X-Ray Absorption studies

Wednesday 5 November 2025 12:00 (30 minutes)

The PHELIX undulator beamline is installed at the synchrotron SOLARIS [1], a third-generation light source with an electron energy of 1.5 GeV and a current of 500 mA. The beamline is designed for experiments with ultra-high vacuum Photoelectron Spectroscopy (PES) and X-ray Absorption Spectroscopy (XAS) in the soft X-ray range. In the future, Ambient Pressure X-ray Photoelectron Spectroscopy (NAP-XPS) will be available at the second branch.

The soft X-ray PES and XAS end station aims to study the electronic structure of various materials, ranging from highly ordered crystalline solids to amorphous phases like ceramics, glass, or minerals. The wide range of available techniques makes this end station a powerful and unique tool for studying very complex systems. PES experiments can be conducted using Angle Resolved Photoelectron Spectroscopy (ARPES), Circular Dichroism-ARPES, Spin-ARPES, and XPS. The SPECS PHOIBOS 225 energy analyzer with a deflector system and CMOS camera allows for collecting photoemission data with an energy resolution of 2 meV and an angular resolution of 0.1°. Absorption spectra can be obtained using Total Electron Yield (TEY), Total Fluorescence Yield (TFY), and Partial Electron Yield (PEY).

The source of the PHELIX beamline is the APPLE-II type undulator, which delivers soft X-rays with the following parameters:

• Photon energy range: 40 eV to 2000 eV (horizontally polarized light),

• Polarization: linear (horizontal and vertical), circular (left- and right-handed) and elliptical,

• Photon flux: approximately 1012 photons/s at 150 eV and around 1011 photons/s for photon energies above 600 eV,

• Beam spot size on the sample: approximately 120 μm × 50 μm (horizontal × vertical).

The end station includes an MBE chamber capable of evaporating Fe, Co, and Sn, with the option to install additional evaporation sources. The preparation chambers enable sample preparation in a wide temperature range from 120 K to 2000 K.

[1] Szlachetko, J., Szade, J., Beyer, E. et al. Correction to: SOLARIS National Synchrotron Radiation Centre in Krakow, Poland. Eur. Phys. J. Plus 138, 595 (2023). https://doi.org/10.1140/epjp/s13360-023-04211-x

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