

2D-CCD/3D-Spin VLEED Detector

STATE-OF-THE-ART COMBINED DETECTOR FOR
PHOIBOS ELECTRON ANALYZER SERIES

KEY FEATURES

- Full 3D Spin Detection Capability
- Fullsize 2D-CCD Detector
- Angle Resolution of
Spin Detector $\leq 0.3^\circ$
CCD Detector $< 0.1^\circ$
- Seamless Software Integration in SpecsLab Prodigy



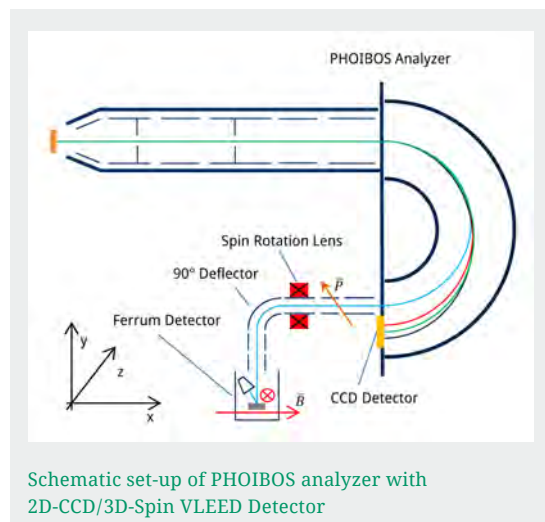
SPÉCS™

State-of-the-art combined detector for PHOIBOS electron analyzer series.

Technical Concept

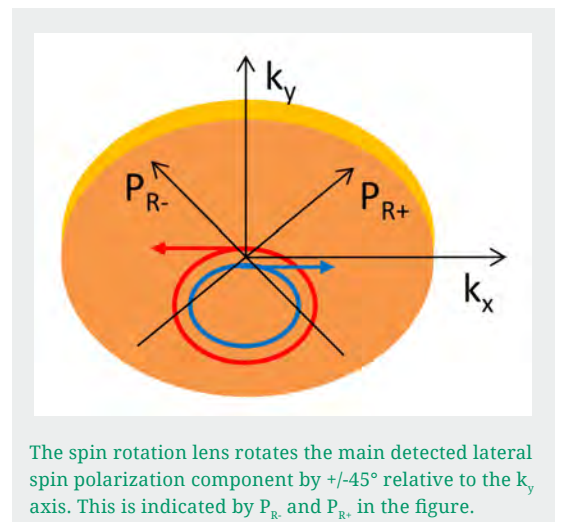
2D-CCD/3D-Spin VLEED Detector

SPECS has integrated the Ferrum VLEED spin detector (FOCUS GmbH) into its proven 2D-CCD/3D-Spin Detector concept. Using a transfer lens with electrostatic 90° deflector and the patented (PCT/EP2011/070226) spin rotation lens, the Ferrum detector is enabled to perform at full 3D spin detection capability. The uniquely high signal from the Ferrum detector is thus combined with the proven performance of the PHOIBOS 2D-CCD analyzers. The addition of spin detection does not compromise the performance of the CCD detection, which retains exactly the same size and performance as for the standard SPECS CCD detector. The 2D-CCD/3D-Spin VLEED detector can be retrofitted on PHOIBOS 150 and PHOIBOS 225 analyzers. The seamless integration of the detector into SpecsLab Prodigy makes high end spin resolved ARPES measurements a routine task.



The Spin Rotation Lens

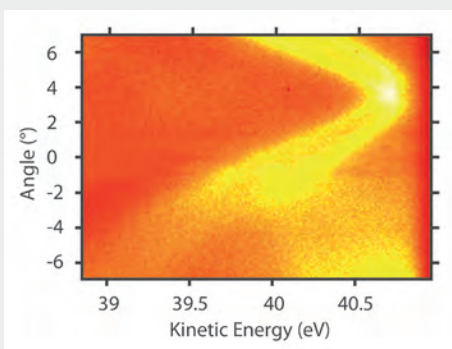
The spin rotation lens rotates the transversal component of the spin polarization, \vec{P} , by $\pm 45^\circ$. In combination with a 90° electrostatic deflector, this gives access to all three components of the spin polarization vector. Magnetization of the scattering target of the VLEED detector in the x-direction gives access to the spin polarization component normal to the sample surface. Magnetization of the target in the z-direction gives access to one of the polarization components parallel to the sample surface, depending on the setting of the spin rotation lens.



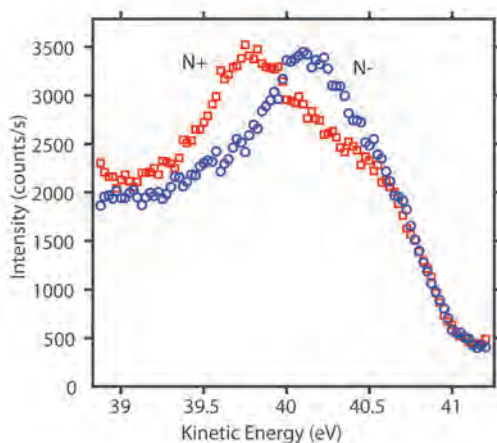
Applications

Graphene on Ir(111)

Graphene on Ir(111) is an excellent material for spin resolved ARUPS measurements. The results presented below have been taken with the 2D-CCD/3D-VLEED detector mounted on a PHOIBOS 150 analyzer. For excitation a SPECS UVS 300 small spot UV-source with a photon energy of 40.81 eV (HeII) has been used.



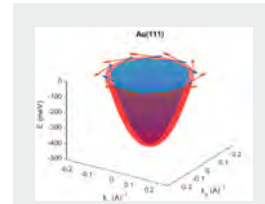
CCD detector image of the surface state of Graphene on Ir(111) in Low Angular Dispersion lens mode (LAD) using a pass energy of 20 eV.



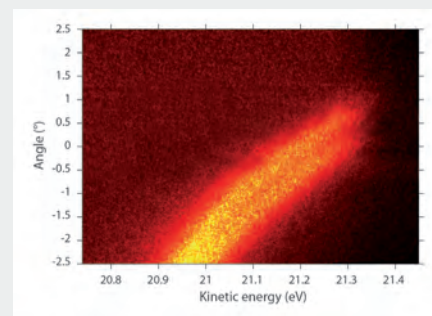
Spin component spectra of Graphene on Ir(111) recorded with the VLEED channel of the 2D-CCD/3D-Spin detector. The total acquisition time is 2.5 min.

Au(111)

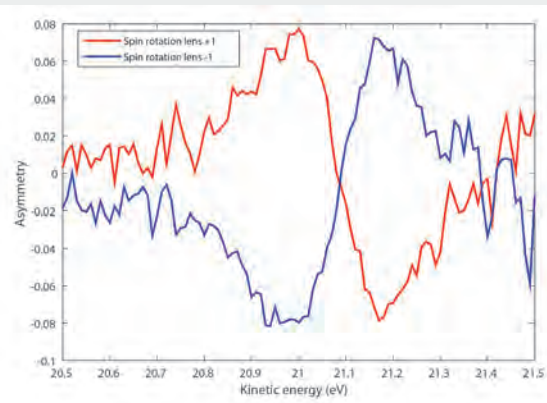
The results have been taken with the 2D-CCD/3D-VLEED detector mounted on a PHOIBOS 225 analyzer. For excitation a SPECS UVS 300 small spot UV-source with a photon energy of 21.22 eV (HeI) has been used.



Spin polarized surface state of Au(111)



Surface state of Au(111) recorded at room temperature in High Angular Dispersion lens mode (HAD) with 10 eV pass energy.



The asymmetry plots show the expected sign reversal when the direction of spin rotation is reversed, due to sign inversion of the spin polarization vector of the Rashba surface states along P_R and $P_{R'}$. The spin component spectra has been recorded with the VLEED detector in 20 min total acquisition time.

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