The Spin- and Angle-Resolved Photoelectron Spectrometer

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Abstract

We are commissioning a spin- and angle-resolved x-ray photoelectron spectrometer (ASR-XPS) for the study of magnetic materials. The ARS-XPS when coupled with a synchrotron source is capable of determining the quantum numbers of a field electronic state of a sample. For a solid sample, it can determine the E versus k of the valence band as well as the character (s, p, d, f...) and spin state (m_l and m_s). The instrument will be assembled and tested at UA and moved to a synchrotron source.

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Quantum Number | How Obtained
--- | ---
\( n \) | XPS
\( l \) | XPS
\( m_l \) | Angle Resolved
\( m_s \) | Spin Resolved

Schematic of Spin-and Angle-Resolved XPS

Spin Orbit and Exchange

- Magnetic X-Ray Circular Dichroism
- 2 ML of FeCo on Cu(001)
- This shows the Fe and Co moments are aligned.
- The spin and orbital contributions to the magnetic moment can be extracted from the measurement.

- Magnetic X-Ray Linear Dichroism
- 2 ML of FeCo on Cu(001)
- Performed in remanence with opposite magnetic fields
- The difference between the scans shows spin states
- Performing this measurement with spin resolution allows one to extract the spin and orbital contributions to the net magnetic moment.
- The effect of the local environment on the spin state may be detected with this measurement.

X-Ray Magnetic Dichroism

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Conclusion

This instrument will be use to study ferromagnetic and antiferromagnetic materials. Combining polarized x-rays with spin analysis enables the determination of the net magnetic moments in antiferromagnetic materials.

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