Experimental Techniques Employed in Quantum Matter Research

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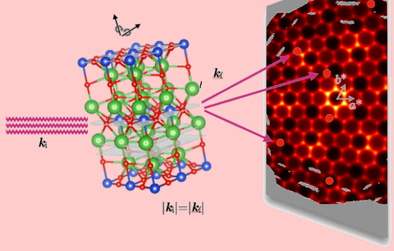
XRD

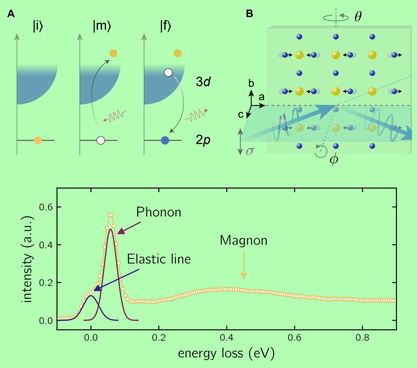
X-**R**ay **D**iffraction



In diffraction experiments the incoming x-ray beam and the scattered waves give rise to a complex constructive and destructive interference effect. The resulting diffraction pattern depends on the relative arrangement of the constituents of the crystal lattice.
Thus, diffraction is an invaluable research tool to obtain structural information and to learn about the statistics of atomic correlations within the sample.

RIXS

Resonant **I**nelastic **X**-ray **S**cattering



In a RIXS process, photons transfer energy and momentum to the sample and leave behind excitations in lattice, charge, spin, and orbital degrees of freedom.
In particular, the electronic excitations are strongly enhanced due to the resonant process.

Quantum Matter

Unconventional superconducters are just one exemplary material group in the fascinating zoo of quantum matter. In such compounds, the interactions between the $\sim 10^{23}$ electrons create phases and physical phenomena that are not well understood and often seem to defy our understanding. They also bear tremendous potential for applications that waits to be unleashed.

In order to illuminate the darkness of our current ignorance, condensed matter phycisists rely on a wide range of sophisticated experimental techniques. The ones listed on this poster present just the fraction of methods that is routinely employed by Johan Chang's Laboratory for Quantum Matter Physics (QMAP) at UZH.

Students wanted!

Opportunities for Bachelor and Master projects are always present and ever changing and we are warmly welcoming interested students! Under normal circumstances, students can get the possibility of joining a synchrotron experiment at the large-scale facilities spread around the world. Direct work in the in-house lab or in cyberspace (developing AI based approaches) is also possible.

In order to find the intersection between your personal preferences and the current experimental reality, you best talk to a member of the QMAP group directly or write to Johan Chang at `johan.chang@physik.uzh.ch`.

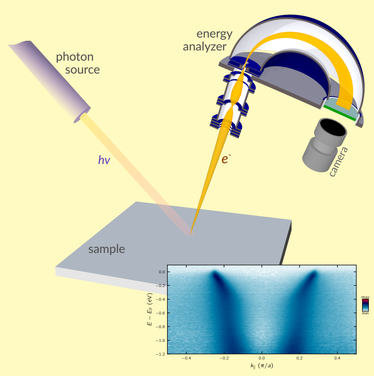
PPMS

Physical **P**roperties **M**easurement **S**ystem

A PPMS allows for systematic measurements of macroscopic physical properties such as the resistivity ρ, magnetization $\mathbf{M}$ or the heat capacity χ. These observables can be measured as functions of the temperature T, an applied voltage or mechanic strain or pressure.

ARPES

Angle-**R**esolved **P**hotoemission **S**pectroscopy



ARPES is a *photon in, electron out* experiment based on the photoelectric effect. The ejected electrons are sorted according to their momentum and energy. This allows us to directly probe the electronic dispersions inside a sample.

In other words, this technique fascinatingly generates *photographs* of the energy distribution in reciprocal space!

Contact