

CORPES05: One Week Workshop and Six Week Seminar „Strong Correlations and ARPES: Recent Progress in Theory and Experiment”.

The CORPES05 seminar was organised by the Max Planck Institute for the Physics of Complex Systems (MPIPKS) in Dresden, from March 29th to May 6th 2005; the more intense workshop took place in the week of April 4 - 8. Scientific coordinators were Jörg Fink from the Leibniz Institute of Solid and Materials Research, Dresden, Konrad Matho from the Center for Low Temperature Research, Grenoble, and Erwin Müller-Hartmann from the University of Köln. There were several reasons to stage these events in 2005.

One hundred years ago, in the first of five famous papers of his *annus mirabilis*, Albert Einstein postulated the dual nature of light – at once particle and wave – and thereby explained the photoelectric effect, among other phenomena. This work was also singled out by the Nobel committee in 1921. The photoelectric effect has since become the basis of one of the most important techniques in solid state research. A rapidly advancing field is angle-resolved photoelectron spectroscopy (ARPES). One decade ago, the focus was on the determination of the band structure of solids. Since the advent of new photon sources from undulators in synchrotron radiation facilities, new analysers with two-dimensional detectors, and new cryo-manipulators it is now possible to measure the spectral function near the Fermi level with high angular (momentum) and energy resolution. One can extract the electronic self-energy function which describes the many-body interactions of the charge carriers. This is of particular importance for “strongly correlated” systems, in which interactions influence the transport and other material properties beyond the mean-field level. Presently, the main focal points for theorists are unconventional superconductors, heavy fermion compounds and low dimensional systems. The purpose of the workshop and the seminar was to strengthen the interface between ARPES and the many-body theory and to explore new ways of analysing a rapidly increasing wealth of experimental data.

In the opening talk of the workshop Philippe Aebi of Fribourg asked the provocative question: “Do we even understand ARPES results from simple systems such as Cu-metal?” In fact, the still poorly understood process of exchange between photon and electron, manifest in the matrix element effects, remained a unifying theme throughout the meeting. Photon sources such as laser light and soft X-rays present new challenges to theory. The central topic was the measurement and interpretation of ARPES results on high-temperature superconductors. Several speakers discussed the evidence for a simultaneous presence of electron-electron, electron-phonon and magnetic interactions in the spectral function. Understanding the dominant mechanism in the dressing of the charge carriers at the lowest energies is of particular interest since it is related to the origin of the attraction that causes superconductivity. Mike Norman of Argonne gave an excellent overview to the Dresden physics community in the MPIPKS colloquium. Other highly correlated systems such as heavy fermions, transition metals with poorly understood polaronic effects, new oxide superconductors and low dimensional systems were treated in both the seminar and the workshop. Finally, in a well attended lecture to the Dresden public, Stefan Hübner of Saarbrücken described a century of the photoelectric effect, from the few facts Einstein knew when he made his bold interpretation to the electronic technology of the 21st century.

CORPES05 took place in the pleasant atmosphere of the MPIPKS, favoring discussions in the lecture hall and around the posters. Nearly all important groups working in the field of ARPES and in the theory of strongly correlated systems were represented. Young scientists, many of them benefiting from financial support of the International Institute for Complex Adaptive Matter (IICAM), were impressed by the possibilities of the ARPES technique and by the recent developments in the theory of correlated systems. Participants frequently expressed the conviction that CORPES05 should be a starter in a series of similar events to highlight further developments of a fast moving field.