PAUL SCHERRER INSTITUT

PSI facilities newsletter

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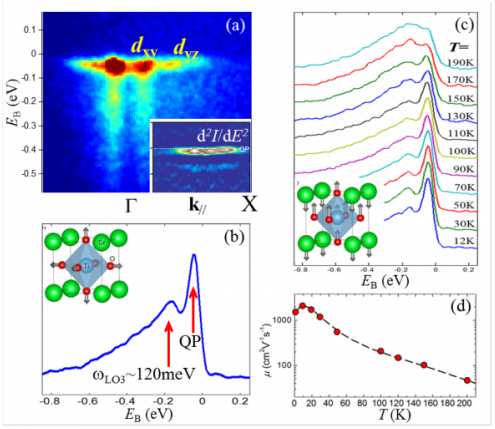
HERCULES at Swiss Light Source

HERCULES
higher european research course for users of large experimental systems

From 11 - 15 April the PSI hosted a group of 20 young physicists, chemists and biologists for practical training at the SLS. The 4.5-week HERCULES course is designed for students, postdoctoral fellows, and senior scientists from European universities and laboratories, in the field of neutron and synchrotron radiation for studies in diverse areas of biology, chemistry, physics, materials science, geosciences, and industrial applications. Emphasis is given to experimental training in small groups of four participants.The training sessions are performed at cutting-edge experimental facilities, e.g., such as those used for research at the TOMCAT, X-TREME, POLLUX, SIM, ADRESS, SIS and PXIII beamlines. The course also features tours and lectures covering science at SLS, as well as PSI's other large scale facilities, including SμS, SINQ, the Center for Proton Therapy and SwissFEL. Participants also benefit from close interactions with the staff scientists of the SLS. In addition, this year's course will address the proposal writing and review process at the synchrotron, with opportunities to interact with the proposal review committee members themselves.
Further information: http://hercules-school.eu/

Research highlight



Polaronic metal state at the La AlO_3/$SrTiO_3$ interface

C. Cancellieri et. al., Nature Communications 7, Article number: 10386, Published 27 January 2016, DOI: 10.1038/ncomms10386

Interplay of spin, charge, orbital and lattice degrees of freedom in oxide heterostructures results in a plethora of their fascinating properties, which can be exploited in new generations of electronic devices whose functionality would combine field effect, superconductivity, ferromagnetism, etc. A research team led by scientists from the SLS has discovered a polaronic nature of electron transport at the paradigm interface of two oxides $LaAlO_3$ and SrTiO. The researchers used soft-X-ray angle-resolved photoelectron spectroscopy the ADRESS beamline, presently the worldwide highest brilliance source of soft X-rays, to penetrate through the $LaAlO_3$ overlayer and resonantly accentuate the response of the charge carriers at the buried interface. The experimental results achieved at ultrahigh energy resolution directly identify these charge carriers as large-radius polarons, emerging from coupling of the charge and lattice degrees of freedom, and involving two phonons of different energy and thermal activity. The breathing LO3 phonons at ~120 meV, observed as the characteristic peak-dip-hump structure in the experimental spectral function $A(\omega,k)$, set the fundamental low-temperature limit of the interfacial charge carriers mobility. In turn, the polar TO1 phonons, changing their frequency from ~18 to 14 meV across the phase transition in $SrTiO_3$, cause fading of the quasiparticle weight in $A(\omega,k)$ with temperature, which resolves the microscopic mechanism behind the dramatic mobility drop observed in transport. The multiphonon polaronic activity at the $LaAlO_3$/$SrTiO_3$ interface can also be the driving force behind its low-temperature superconductivity. This discovery paves a way towards new operational principles of efficient and power-saving solid-state electronics based on oxide heterostructures.