

Séminaire SOLEIL

Soft-X-Ray ARPES at SLS: Electronic Structure of 3-Dimensional Systems and Buried Heterostructures

V.N. STROCOV

(Swiss Light Source, Paul Scherrer Institute, CH-5232 Villigen-PSI, Switzerland)

Invité par Antonio TEJEDA

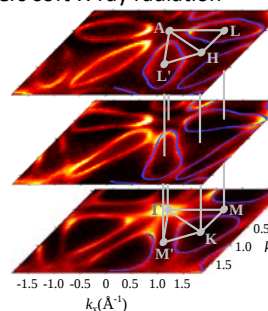
Lundi 12 novembre à 14h00
Grand Amphi SOLEIL

Séminaires

A fundamental benefit of pushing the ARPES experiment into the soft-X-ray energy range is the increasing photoelectron escape depth λ . This gives a boost to bulk sensitivity of ARPES as well as enables access to buried heterostructures. Furthermore, by the Heisenberg uncertainty principle, the increase of λ improves intrinsic resolution in surface-perpendicular momentum $\Delta k_z = \lambda^{-1}$. With free-electron final states and simplified matrix elements achieved in the soft-X-ray energy range, the improved k_z definition enables exploration of electronic structure of 3-dimensional (3D) systems under full control of the 3D momentum $\mathbf{k}$.

The soft-X-ray ARPES facility at SLS is installed at the ADRESS beamline [1] which delivers soft-X-ray radiation with variable polarizations in a photon energy range from 300 to 1600 eV. High photon flux topping up 10^{13} photons/s/0.01%BW at 1 keV has taken us through the notorious problem of small valence band crosssection in the soft-X-ray range. At energies around 900 eV, ARPES images of publication quality are routinely acquired within 5 min at a combined energy resolution of 110 meV, and within 30 min at resolution of 60 meV.

Apart from the key technical issues, I give an overview of the most important results achieved with the new facility. They include determination of 3D Fermi surface (FS) of VSe_2 (figure), with out-of-plane warping of the FS giving rise to exotic 3D charge density waves; polarization dependence and alternating FS shapes in pnictide HTSCs, revealing their 3D character and intra-cell interference effects; 3D hybridization between sp - and f -states in heavy-fermion systems; topological surface state embedded in 3D valence band of PbBi_4Te_7 , with spatial oscillations of its wavefunction reflected in photon energy dependence of ARPES intensity; electronic structure of Mn magnetic impurities in 3D host lattice of diluted magnetic semiconductor FS of buried layers in $\text{LaNiO}_3/\text{LaAlO}_3$ and $\text{SrTiO}_3/\text{LaAlO}_3$ heterostructures, depth localization of 2D electron gas in mixed-valence $\text{LaAlO}_3/\text{SrTiO}_3$ systems; standing X-ray waves excited ARPES of $\text{BiFeO}_3/\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ multilayer heterostructures allowing depth resolved profiling of its electronic structure; etc. These unfolding results demonstrate an immense potential of soft-X-ray ARPES to deliver a clear view of the electronic structure of 3D systems and buried heterostructures.



[1] V.N. Strocov et al, J. Synchrotron Rad. **17**, 631 (2010)

**Ce séminaire sera suivi d'une pause-café**

Formalités d'entrée : accès libre dans l'amphi du Pavillon d'Accueil. Si la manifestation a lieu dans le Grand Amphi SOLEIL du Bâtiment Central, merci de vous munir d'une pièce d'identité (à échanger à l'accueil contre un badge d'accès).

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Division Expériences - L'Orme des merisiers - Saint-Aubin - BP 48 - 91192 GIF S/YVETTE Cedex

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