O 51: Poster: Electronic Structure of Surfaces: Spectroscopy, Surface States

Time: Tuesday 18:15–20:30 Location: Poster B

O 51.1 Tue 18:15 Poster B

Unoccupied electronic structure of the giant Rashba system Bi/Ag(111) probed by two-photon photoemission — •Philipp Rosenzweig[1,2], Sebastian Otto[1], and Thomas Fauster[1] — [1]Lehrstuhl für Festkörperphysik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstr. 7, D-91058 Erlangen, Germany — [2]Max-Planck-Institut für Festkörperforschung, Heisenbergstr. 1, D-70569 Stuttgart, Germany

We probe the unoccupied band structure of the $(\sqrt{3} \times \sqrt{3})R30°$ substitutional surface alloy Bi/Ag(111)—from the Fermi to the vacuum level—by time- and angle-resolved, mono- and bichromatic, polarization-dependent two-photon photoemission (2PPE) at photon energies ranging from 1.51 to 4.89 eV. The obtained 2PPE patterns in $\overline{\Gamma M}$ direction are exceptionally rich in structure, revealing pronounced contributions from the Rashba-split sp_z and p_xp_y ($m_j = 1/2$) initial states. The latter state is found to disperse downwards from (0.65 ± 0.03) eV above the Fermi level with a Rashba parameter of (3.0 ± 0.5) eVÅ—consistent with DFT calculations [1] and previous experiments [2, 3]; the corresponding lifetime is extracted as (26 ± 5) fs. The higher-lying, fully unoccupied p_xp_y ($m_j = 3/2$) surface state can also be identified in remarkable agreement with theory [1]. Close to the vacuum level, the 2PPE patterns reveal signatures of three image-potential resonances and the unoccupied Ag bulk *sp* band.

[1] Bihlmayer et al., Phys. Rev. B **75,** 195414 (2007).
[2] El-Kareh et al., Phys. Rev. Lett. **110,** 176803 (2013).
[3] Wissing et al., Phys. Rev. Lett. **113,** 116402 (2014).

O 51.2 Tue 18:15 Poster B

Electron-electron coincidences from surfaces - The new CoESCA station at Bessy II — •Torsten Leitner[1,2], Ieva Bidermane[1,3], Ruslan Ovsyannikov[1,3], Frank O. Schumann[4], Svante Svensson[1,2], Alexander Föhlisch[1,3], and Nils Martensson[1,2] — [1]UBjL - Uppsala-Berlin joint Laboratory, Berlin, Germany — [2]Uppsala University, Sweden — [3]Helmholtz-Zentrum Berlin, Germany — [4]Max-Planck Institut für Mikrostrukturphysik, Halle, Germany

We introduce the new CoESCA experimental station for electron-electron coincidences from surfaces, which is open for external users at the BESSY II synchrotron facility. The station is equipped with two Angular-resolved Time-Of-Flight (ArTOF) electron spectrometers and a state-of-the art sample manipulation and preparation system. We show first results from photo electron - Auger electron coincidences from Ag and present an outlook on future research opportunities.

O 51.3 Tue 18:15 Poster B

Electron-Rich surface of thin $La_{0.7}Sr_{0.3}MnO_3$ films revealed by Surface-Enhanced Raman Spectroscopy — •Sebastian Merten, Vitaly Bruchmann-Bamberg, Bernd Damaschke, Konrad Samwer, and Vasily Moshnyaga — I. Physikalisches Institut, Georg-August-Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

Perovskite manganites are appealing materials for various potential applications in spintronics, catalysis or fuel cells. For all of them the electronic and atomic structure of the surface/interface is crucial for the performance of the future device. Unfortunately, the understanding of the manganite surface is still in its infancy. Surface-Enhanced Raman (SER) Spectroscopy represents a versatile tool to simultaneously probe different degrees of freedom and the small penetration depth of the surface plasmon (< 5nm) limits the probing area to the surface layers. Here, we present a detail SER study of thin $La_{0.7}Sr_{0.3}MnO_3$ (LSMO) films grown on different substrates. SER spectra reveal a Jahn-Teller (JT) dominated surface structure, in contrast to the "bulk" Raman spectra where the JT modes are suppressed due to the rhombohedral structure of LSMO. Our experiments confirm theoretical calculations, which show a charge-transfer from the bulk to the surface and thus, formation of Mn^{3+}-ions at the surface. Furthermore, an enhancement of a specific JT mode depending on the epitaxial strain was observed. Temperature-dependent measurements reveal a second transition temperature at around $T = 260$ K. Financial support from DFG via SFB 1073 (TP B01, B04 and A02) is acknowledged.

O 51.4 Tue 18:15 Poster B

Potassium Doping of a Correlated Triangular Adatom Lattice — •Julian Maklar, Florian Adler, Jörg Schäfer, and Ralph Claessen — Physikalisches Institut and Röntgen Center for Complex Material Systems (RCCM), Universität Würzburg, D-97074 Würzburg, Germany

Triangular lattices of localized electrons exhibit a rich phase diagram including spin liquids and exotic superconductivity due to geometric frustration and electronic correlations. Yet, the conditions for these regimes are not fully explored, as experimental realizations are rather limited. The focus of our research is on submonolayer triangular lattices of group IV adatoms on semiconductor substrates. Due to their simplicity and tunability by variation of adatoms and substrates, this material class can serve as a model system to study electronic correlations and frustration.

In this study utilizing ARPES and STM we investigate electron doping by K deposition on a triangular Sn atom lattice on Si(111). At low temperatures, Sn/Si represents a Mott-insulator with row-wise antiferromagnetic order, evident from backfolding of the Sn surface band. Upon K deposition, surprisingly a metal-insulator transition does not emerge. Instead we detect a sharpening of the Sn band followed by a rigid band shift towards higher binding energies. Furthermore, signatures of antiferromagnetic order are destroyed. STM measurements reveal a honeycomb reconstruction of K atoms on the Sn lattice after a deposition of 1/6 monolayer. This setup opens the door to search for exotic states of matter, specifically topological superconductivity.

O 51.5 Tue 18:15 Poster B

Scattering at single, non-magnetic bulk impurities in Cu — •Thomas Kotzott, Henning Prüser, and Martin Wenderoth — IV. Physikalisches Institut - Solids and Nanostructures, Georg-August-Universität Göttingen, Germany

The scanning tunneling microscope is most commonly used as tool for surface science. However, making use of the electron focusing effect the STM can also give an insight into the solid and then reveals a powerful combination of atomic lateral resolution and probing bulk properties. Here, we investigate the scattering process of bulk electrons at single, non-magnetic impurities and compare the properties of Ge with Ag within a Cu crystal.

Dilute alloys of Ge/Ag in Cu are prepared in-situ under UHV conditions. Cu and the impurity material Ge/Ag are simultaneously evaporated from electron beam evaporators onto a single crystal Cu(100) surface. STM and STS was performed using a home-built low-temperature setup operating at 6 K and $p < 5 \cdot 10^{-11}$ mbar.

Topography data reveals ring-like features in the local density of states with electronic contrasts down to few picometers in height. These signatures are attributed to the electrons being scattered at the impurity and propagating along the distinguished paths of electron focusing. Spectroscopy accesses the differential conductance with energy resolution and therefore resolves the scattering of different bulk states at the impurity. Comparing different non-magnetic impurities allows to expand the understanding of scattering processes on the atomic level.

O 51.6 Tue 18:15 Poster B

Numerical Calculations of Metastable Induced Electron Spectra (MIES) — •Tobias Bernd Gäbler, Wichard J. D. Beenken, and Erich Runge — Technische Universität Ilmenau, Institut für Physik, Ilmenau, Germany

We present ab initio calculations of the transition rates of the Auger de-excitation of metastable helium interacting with molecules. Following the simplifying assumptions by Kantorovich et al. [Surf. Sci. 444, 31 (2000)], we calculated the exchange matrix-elements relevant for the de-excitation by a MATLAB program based on molecular orbitals as result from standard quantum-chemical software packages like Gaussian. Thereby, density functional theory (B3LYP) and the Hartree-Fock method can be utilized. Both methods show only slight differences in the calculated transition rates. However, the Hartree-Fock method may be theoretically better justified for the applicability of the Koopman's theorem, and practically preferable due to a better correspondence of calculated ionization energies with the peak positions in measured MIES spectra. We will demonstrate calculated MIES spectra averaged over given trajectories of Helium atoms along

the molecule.

O 51.7 Tue 18:15 Poster B

Probing low-energy correlations on μm length-scales with ultimate energy and momentum resolution — •Eike F. Schwier[1], Hideaki Iwasawa[2], Mashashi Arita[1], Hitoshi Takita[3], Umut Mansur[3], Akihiro Ino[1], Hirofumi Namatame[1], Masaki Taniguchi[1], Yoshihiro Aiura[4], and Kenya Shimada[1] — [1]Hiroshima Synchrotron Radiation Center, Hiroshima University, 2-313 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-0046, Japan — [2]Diamond Light Source, Harwell Science and Innovation Campus, Didcot OX11 0DE, United Kingdom — [3]Graduate School of Science, Hiroshima University, 1-3-1 Kagamiyama, Higashi-Hiroshima 739-8526, Japan — [4]National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki 305-8568, Japan

We have developed a μ-ARPES system by combining the advantages of conventional high-resolution laser ARPES and spatially-resolved scanning PES. We use an optical lens system to focus our laser beam down to 5 μm and harness the available spatial resolution by using an XYZ stage with sub-μ precision of movement. Our μ-ARPES machine is able to revealed both intrinsic and extrinsic spatial inhomogeneity in the electronic structure with outstanding accuracy and more generally allows to choose surface regions and light conditions that greatly improve on conventional ARPES results. Here we present examples of our machines performance, focusing on spatially resolved measurements with high energy and/or angular resolution of superconducting materials and topological insulators.

O 51.8 Tue 18:15 Poster B

Quantifying the charge density wave properties in VSe_2 — •Timo Knispel[1], Wouter Jolie[1,2], Niels Ehlen[1], Konstantin Nikonov[1], Carsten Busse[2,3], Alexander Grüneis[1], and Thomas Michely[1] — [1]II. Physikalisches Institut, Universität zu Köln, Germany — [2]Institut für Materialphysik, Westfälische Wilhelms-Universität — [3]Department Physik, Universität Siegen

We use scanning tunneling microscopy and spectroscopy (STS) to image the charge density wave (CDW) at the surface of VSe_2 and to probe its local density of states. Angle-resolved photoemission and tight-binding calculations are used to link the main features observed in STS spectra to contributions of the p-like and d-like bands of VSe_2. A transparent method to estimate the partial CDW gap based on STS spectra is provided. The estimated CDW gap of 26±6 meV is is in good agreement with the transition temperature of VSe_2, pointing to weak electron-phonon coupling. This leads to the conclusion that the Peierls model of Fermi surface nesting is applicable in this material. The role of defects is investigated, which reveals that the partial gap in the density of states and hence the CDW itself is extremely stable, though the periodic modulation and amplitude of the CDW on the surface are strongly perturbed.

O 51.9 Tue 18:15 Poster B

The 2x1 reconstruction of the LaB6 (001)-surface observed by Scanning Tunneling Microscopy — •Philipp Buchsteiner[1], Jan Voigt[1], Geetha Balakrishnan[2], and Martin Wenderoth[1] — [1]IV. Physikalisches Institut, Georg-August Universität Göttingen, Germany — [2]Department of Physics, University of Warwick, United Kingdom

Lanthanum Hexaboride (LaB6) is widely used as cathode emitter due to its chemical stability and low work function of the (001)-surface [1]. We investigate the (001)-surface obtained by in situ cleavage at room temperature. The sample is directly transferred to our home built low temperature (6 K) Scanning Tunneling Microscope (STM). Our measurements unravel for the first time that a chain-like 2x1 reconstruction is present at the surface. Since LaB6 is built from positively charged La ions and negatively charged B6 molecules such an arrangement can avoid an unfavourable surface polarization. Such a 2x1 reconstruction has been observed for cleaved Samarium Hexaboride (SmB6) (001)-surfaces as well [2]. However, this modification has not been found on heated LaB6 (001)-surfaces, where only non-reconstructed areas with numerous vacancies have been observed [3]. Contrarily to this findings non-reconstructed areas obtained by cleavage do not exhibit such a high vacancy concentration. This work is supported by the DFG. [1] M. Trenary, Sci. Technol. Adv. Mater., 13 (2012) [2] S. Rößler et al., Philos. Mag., 96:31, 3262-3273 (2016) [3] J.S. Ozcomert, M. Trenary, Surf. Sci., 265 (1992)

O 51.10 Tue 18:15 Poster B

STM-Investigations of κ-(BEDT-TTF)$_2$X-Charge Transfer Salts — •Johannes Regel[1], Torge Mashoff[1], Harald Schubert[2], Michael Lang[2], Jens Müller[2], and Hans-Joachim Elmers[1] — [1]Institut für Physik, Johannes Gutenberg-Universität, Mainz — [2]Physikalisches Institut, Goethe-Universität, Frankfurt

Organic charge-transfer salts of the κ-$(BEDT\text{-}TTF)_2X$ (short: κ-X) family share essential features with cuprates regarding their superconducting state. In both classes of materials, the electronic structure is quasi two dimensional and superconductivity emerges in the vicinity of the Mott insulating phase, resulting in a strong deviation of the superconducting properties from BCS theory.
We investigate small crystals of the two charge-transfer salts κ-$Cu[N(CN)_2]Br$ and κ-$Cu(NCS)_2$ using a low temperature scanning tunneling microscope and obtain good topographic resolution of the crystallographic structure. Due to the higher chemical pressure of κ-$Cu(NCS)_2$, the two salts differ in the proximity to the Mott phase. We use scanning tunneling spectroscopy to investigate this influence and the electronic properties of the samples.

O 51.11 Tue 18:15 Poster B

Growth studies and angle-resolved photoemission of Fe coatings on the topological Dirac semi-metal α-Sn — •Johannes Jehn, Victor Rogalev, Lenart Dudy, Jörg Schäfer, and Ralph Claessen — Physikalisches Institut und Röntgen Center for Complex Material Systems, Universität Würzburg, 97074 Würzburg, Germany

Topological materials like α-Sn exhibit a band inversion between the p-like conduction and s-like second valence bands. Being compressively strained in (001)-plane, α-Sn enters the Dirac semi-metal phase, with topological surface states (TSS) protected by time-reversal symmetry. A magnetic field breaks this symmetry and is expected to open a gap in the surface states.

We investigate the effect of Fe coatings deposited on α-Sn films grown *in situ* by MBE on InSb(001) substrates. In ARPES, α-Sn samples clearly show linear dispersing surface states with a Dirac point (DP) close to the Fermi level. The position of the DP is controlled by Te doping. Fe impurities are deposited flux-controlled on the surface of α-Sn films with a coverage ranging from sub-monolayer to several monolayers (determined from XPS). Theoretically, a ferromagnetic order mediated by the TSS might be conceivable in such samples. However, in ARPES we observe no gap opening at the DP within our resolution for all Fe coverages. We speculate that the presence of projected bulk states near the Fermi level disturbs the ferromagnetic coupling via the TSS.

O 51.12 Tue 18:15 Poster B

Electronic states on metal/topological insulator heterostructure — •Garima Saraswat, Jan Homberg, Alexander Weismann, and Richard Berndt — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, D-24098 Kiel, Germany

Topological insulators (TI) are of great interest due to their unusual surface states. Exotic properties such as p-wave-like superconductivity and gapped Dirac states have been predicted for proximity coupled superconductor/TI and ferromagnet/TI structures respectively [1]. Normal metal/TI junctions which could be very relevant for device fabrication remain relatively unexplored. In this work we perform scanning tunneling spectroscopy (STS) on few monolayers of Pb deposited on Sb_2Te_3 single crystal surface. We observe a change in the Fermi level as a function of Pb coverage on the surface. Pb nanoislands exhibit quantum well states. The effect of topological surface states on these QW states will be discussed.

[1] M. Z. Hasan and C. L. Kane, Rev. Mod. Phys. **82**, 3045 (2010)

O 51.13 Tue 18:15 Poster B

Symmetry in photoelectron angular distribution of black phosphorus — •Katharina T. Ritter[1], Kenta Kuroda[2], Takeshi Kondo[2], Takao Sasagawa[3], Koichiro Yaji[2], Shik Shin[2], and Markus Donath[1] — [1]Physikalisches Institut, University of Münster, Germany — [2]ISSP, University of Tokyo, Japan — [3]LMS, Tokyo Institute of Technology, Japan

Angle-resolved photoelectron spectroscopy (ARPES) is the technique to investigate the electronic structure of solids and molecules by measuring the photoemitted electron intensity versus their angular distribution or kinetic energy. Recently, the combination of ARPES with ab-initio electronic-structure calculations shows that the photoelectron angular distribution (PAD) can greatly give insights into electronic and

structural properties of organic molecular layers [1]. However, the understanding of the PAD as a result of excitations from Bloch states in solids still remains challenging.

In this contribution, we apply this technique to electronic structure of black phosphorus (BP), which consists of puckered atomic layers coupled by weak inter-layer van der Waals forces. By using high-resolution ARPES combined with 7 eV laser light, we directly map the PAD. Remarkably, it is found that the PAD pattern sensitively depends on the linear polarization of the incident light. From this result, we discuss how the light polarization is related to the symmetry of the electronic state to give rise to the observed PAD pattern.

[1] J. Ziroff *et al.*, Phys. Rev. Lett. **104** (2010) 233004

O 51.14 Tue 18:15 Poster B

STM/AFM study of local work function variations on h-BN/Cu(111) — •Abhishek Grewal[1], Matthias Muenks[1], Yuqi Wang[1], Markus Ternes[1], and Klaus Kern[1,2] — [1]Max Planck Institute for Solid State Research, Heisenbergstrasse 1, 70569 Stuttgart, Germany — [2]Institut de Physique, École Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland

The adsorption of single atoms or molecules on surfaces is mediated by their interaction with the substrate. The surfaces must, therefore, be characterized and understood from the structural, chemical and electronic point of view. In this respect, the nanometer scale local work function variations of the hexagonal boron nitride (h-BN) decoupling layer have been used for explaining favorable adsorption sites and molecular arrangements [1,2]. Using a tuning-fork based combined STM/AFM at 1 K base temperature we study h-BN on a Cu(111) substrate. We find bias dependent electronic corrugations by analyzing constant current and constant height STM images. We compare the local work function variation obtained by field emission resonance states [3] and complimentary Kelvin probe force microscopy at the different areas of this corrugation. Analyzing three-dimensional force maps we do not observe the soft stiffness previously found on h-BN/Rh(111) samples [4].

1. H. Dil et al., Science 319, 1824 (2008).
2. P. Jacobson et al., Nat. Comm. 6, 8536 (2015).
3. S. Joshi et al., Nano Lett. 12, 5821 (2012).
4. T. Herden et al., Nano Lett. 14, 3623 (2014).

O 51.15 Tue 18:15 Poster B

Pb single atom contacts in a STM — •Jan Homberg, Alexander Weismann, and Richard Berndt — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, D-24098 Kiel, Germany

In scanning tunneling spectroscopy, superconducting tips may be used to achieve high energy resolution not limited by Fermi broadening. Here we use Pb tips on a Pb(100) single crystal to investigate single atom contacts. Multiple Andreev Reflections as well as Josephson supercurrents are observed and analysed giving insight into the electronic properties of the contacts.

O 51.16 Tue 18:15 Poster B

Investigation of Honeycomb-Iridate Surfaces by Means of STM and STS — •Thomas Dziuba[1], Felix Lüpke[1], Friedrich Freund[2], Soham Manni[2], Philipp Gegenwart[2], and Martin Wenderoth[1] — [1]IV. Physikalisches Institut, Georg-August-Universität Göttingen, Germany — [2]Experimentalphysik VI, Universität Augsburg, Germany

Honeycomb iridates A_2IrO_3 ($A = Na$ or Li) have attracted much interest as prototype spin-orbit Mott insulators with magnetic Kitaev exchange interaction. They are also considered as promising candidates for novel correlated topological insulator behavior. This motivates detailed microscopic investigations of the surface properties by scanning tunneling microscopy (STM) and spectroscopy (STS). Honeycomb iridates consist of an alternating stacking of negatively charged honeycomb iridate structures and positively charged hexagonal alkali metal layers [1]. Optical conductivity indicates a large bulk bandgap ($340\,meV$ [2]). We found, that the surface of both, pure and partly Li-doped sodium iridate shows 1×1- and 3×1 reconstructions, that in all cases exhibit a surface band gap. This gap depends crucially on the particular reconstruction as well as on the alkali metal configuration, with higher Li-content leading to smaller bandgaps [1]. Recently, α-Li_2IrO_3 single crystals were synthesized [3]. We report first STM/STS measurements on them, revealing interesting surface properties. Work supported by DFG SPP1666. [1] F. Lüpke et al, Phys. Rev. B 91, 041405(R) (2015) [2] V. Hermann et al, Phys. Rev. B 96, 195137 (2017) [3] F. Freund et al, Sci. Rep. 6, 35362 (2016)

O 51.17 Tue 18:15 Poster B

Development of a multichannel spin detector for photoelectron spectroscopy with hard x-rays — •Matthias Schmitt[1], Alexander Wiegand[1], Lenart Dudy[1], Michael Sing[1], Ralph Claessen[1], Sergey Chernov[2], Gerd Schönhense[2], Andrei Gloskovskii[3], Katrin Ederer[3], Christoph Schlueter[3], and Wolfgang Drube[3] — [1]Universität Würzburg, Physikalisches Institut and Röntgen Center for Complex Material Systems, 97074 Würzburg, Germany — [2]Universität Mainz, Institut für Physik, 55128 Mainz, Germany — [3]DESY Photon Science, 22607 Hamburg, Germany

Spin-resolved photoelectron spectroscopy is a powerful technique to directly probe the spin-polarized electronic structure of magnetic systems. However, conventional single channel spin detectors used for spin filtering and detection exhibit very low efficencies and, in addition, lack the possibility to benefit from the two-dimensional imaging capabilities of modern electron energy analyzers with respect to energy and angle. Thus, spin- and angle resolved measurements are in general cumbersome. This applies all the more for the hard x-ray regime where the photoabsorption cross sections are extremely small. Here we report on the development of a multichannel spin detector for hard x-ray photoelectron spectroscopy using a tungsten single crystal for spin-dependent low energy electron diffraction in 90° geometry. We also show first test measurements of magnetite with a spin polarization of -100% at the Fermi energy, performed at PETRA III in Hamburg, Germany.

O 51.18 Tue 18:15 Poster B

Comparative scanning tunneling spectroscopy study of cobalt oxide islands and thin films on Au(111) and Ir(100) — •Maximilian Ammon, Sara Baumann, Lutz Hammer, and M. Alexander Schneider — Lehrstuhl für Festkörperphysik, Universität Erlangen-Nürnberg, D-91058 Erlangen, Germany

Cobalt oxide is of great interest mainly due to its catalytic and magnetic properties [1-3]. It has been shown that cobalt oxide can be epitaxially grown on various single crystal surfaces of noble and transition metals [4-7].

Low-temperature scanning tunneling spectroscopy in ultra-high vacuum is used to study the electronic properties on a local scale. We compare cobalt oxide bi- and trilayer islands with a rocksalt structure on Au(111) [4,7] with corresponding cobalt oxide films on Ir(100). The measured local density of states (LDOS $\propto$ dI/dV) of the oxide is strongly reduced around E_F on both substrates, but the spectral shape varies significantly. On Au(111) the dI/dV signal is reduced to zero in an energy interval of up to 0.5 eV around E_F. In contrast on Ir(100) a sharp, symmetric dip is observed with finite dI/dV signal at E_F.

[1] Fester et al., Nat. Commun. **8**, 14169 (2017) [2] Liao et al., Nat. Nanotechnol. **9**, 69 (2014) [3] Skumryev et al., Nature **423**, 850 (2003) [4] Fester et al., Top. Catal. **60**, 503 (2017) [5] Heinz et al., J. Phys.: Condens. Matter **25**, 173001 (2013) [6] Schindler et al., Surf. Sci. **603**, 2658 (2009) [7] Chassé et al., Surf. Sci. **602**, 443 (2008)

O 51.19 Tue 18:15 Poster B

Probing magnetic interactions between transition metal atoms via YSR states — •Javier Zaldívar[1], Deung-Jang Choi[1,2,3], Carmen Rubio-Verdú[1], Miguel Moreno Ugeda[1], Jose Ignacio Pascual[1], Edwin Herrera[4], Isabel Guillamón[4], Hermann Suderow[4], Carlos García Fernández[3], and Nicolás Lorente[2,3] — [1]CIC nanoGUNE, San Sebastián, Spain — [2]Centro de Física de Materiales CFM/MPC (CSIC-UPV/EHU), San Sebastián, Spain — [3]Donostia International Physics Center, San Sebastián, Spain — [4]Departamento de Física de la Materia Condensada, Instituto Nicolás Cabrera and Condensed Matter Physics Center, UAM, Madrid, Spain

Recent studies proposed the formation of Shiba(YSR) bands in chains of magnetic atoms on superconductors in the presence of spin-orbit coupling as a platform to realize topological superconductivity[1]. However, construction of nanostructures on superconducting materials by atomic manipulation resulted elusive to date, preventing the study of the evolution from single-atom YSR states to Majorana chains.

We compare the YSR excitation spectra of nanostructures built with transition metal adatoms on the surface of β -Bi2Pd [2]. We show these excitations depend on the adsorption state, the mutual interaction, and also track variations due to magnetic fields. Our results provide an insight into the nature of magnetic interactions on a superconductor at

the atomic scale at the early stages of chain formation.

[1] S. Nadj-Perge et al., Science 34, 6209 (2014)
[2] D. -J. Choi et al., arxiv: 1709.09224 (2017)

O 51.20 Tue 18:15 Poster B

Growth and electronic structure characterization of $FeSe_xTe_{1-x}$ thin films on a topological insulator — •Thiago R. F. Peixoto[1], Simon Müller[1], Sujit Manna[2], Jagadeesh Moodera[2], and Friedrich Reinert[1] — [1]Experimental Physics VII and Röntgen Center for Complex Materials, Universität Würzburg — [2]Department of Physics, Massachussets Institute of Technology, Boston, USA

The realization of a topological superconductor state at the interface between a strong three-dimensional topological insulator (3D-TI) and an s-wave superconductor is one of the central issues in condensed matter physics nowadays [1]. In iron-based superconductors, the presence of magnetic species may yet break the time-reversal symmetry of the TI non-trivial electronic structure, allowing the existence of chiral Majorana fermions [1]. Here we report the successful growth of high quality $FeSe_xTe_{1-x}$ films on 3D-TI (Bi,Sb)Se_xTe_{3-x} substrates by means of molecular beam epitaxy. Low-energy electron diffraction (LEED) and X-ray photoemission spectroscopy (XPS) experiments confirm the formation of 1-2 unit cells Fe(Se,Te) film with a high surface quality. Angle-resolved photoemission spectroscopy (ARPES) has been performed at temperatures between 1 K and 20 K, at photon energies between 20 eV and 150 eV, and for both linear polarizations, showing typical signatures of the FeSeTe valence band structure along the surface high symmetry directions. Our data is discussed in comparison with well-established ARPES results and band structure calculations.

[1] L. Fu and C. L. Kane, *Phys. Rev. Lett.* **100**, 096407 (2008).