

## O 64: Poster Session V: Electronic structure of surfaces: Spectroscopy, surface states III

Time: Wednesday 10:30–12:30

Location: P

O 64.1 Wed 10:30 P

**Adlayer influence on Dirac-type surface state at W(110)** — ●PASCAL JONA GRENZ<sup>1</sup>, DANNY THONIG<sup>2,3</sup>, MARCEL HOLTSMANN<sup>1</sup>, KOJI MIYAMOTO<sup>4</sup>, SHIV KUMAR<sup>4</sup>, EIKE SCHWIER<sup>4,5</sup>, TAICHI OKUDA<sup>4</sup>, JÜRGEN HENK<sup>6</sup>, and MARKUS DONATH<sup>1</sup> — <sup>1</sup>University of Münster, Germany — <sup>2</sup>Uppsala University, Sweden — <sup>3</sup>Örebro University, Sweden — <sup>4</sup>Hiroshima Synchrotron Radiation Center, Japan — <sup>5</sup>University of Würzburg, Germany — <sup>6</sup>Martin Luther University Halle-Wittenberg, Germany

In a combined experimental and theoretical study, we investigated how Fe and Co adlayers on W(110) affect the Dirac-type surface state (DSS). Angle-resolved photoelectron spectroscopy data show an increase in binding energy of 75 meV and 107 meV for Fe and Co, respectively. To identify the origin of the energy shift, we performed first principle calculations of the surface electronic structure. The inward surface relaxation of the uncovered W(110) surface is lifted by the adlayers. This structural change is one reason of the energy shift of the DSS. Furthermore, the Fe and Co adlayers lead to a reduced charge distribution of the DSS at the vacuum side, which results in an additional energy shift of the DSS.

O 64.2 Wed 10:30 P

**Spin and Orbital Angular Momentum observed by Linear Dichroism: Interplay of Inversion Symmetry Breaking and Spin-Orbit Coupling** — ●MAXIMILIAN ÜNZELMANN<sup>1</sup>, HENDRIK BENTMANN<sup>1</sup>, TIM FIGGEMEIER<sup>1</sup>, RAPHAEL CRESPO VIDAL<sup>1</sup>, THIAGO R. F. PEIXOTO<sup>1</sup>, HENRIETTE MAASS<sup>1</sup>, CHUL-HEE MIN<sup>2</sup>, and FRIEDRICH REINERT<sup>1</sup> — <sup>1</sup>Experimentelle Physik 7, Universität Würzburg — <sup>2</sup>Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel

The formation of spin- and orbital angular momentum (SAM and OAM) for electronic states in non-centrosymmetric crystal-structure environments is shaped by a complex interplay of inversion symmetry breaking (ISB) and spin-orbit coupling (SOC) as well as their characteristic energy scales [1]. This phenomenon plays an important role in many modern quantum materials, such as topological insulators and Weyl semimetals [2,3]. Devising experimental approaches to access SAM and OAM is thus of fundamental interest. By means of spin- and angle-resolved photoemission we have investigated the photoelectron spin polarization and the linear dichroism (LD) [4] in various materials with spin-polarized surface states. Our results suggest that LD is linked to the OAM [5] in regimes dominated by either SOC or ISB.

[1] V. Sunko et al., *Nature* 549, 492 (2017)[2] M. Schüler et al., *Sci. Adv.* 6, eaay2730 (2020)

[3] M. Ünzelmann et al., arXiv:2012.06996 (2020)

[4] H. Bentmann et al., *Phys. Rev. Lett.* 119, 106401 (2017)[5] M. Ünzelmann et al., *Phys. Rev. Lett.* 124, 176401 (2020)

O 64.3 Wed 10:30 P

**Unconventional Surface Conductivity in Correlated Honeycomb Transition Metal Oxide Mott Insulators** — ●THOMAS DZIUBA<sup>1</sup>, MÁTÉ STARK<sup>1</sup>, INA PIETSCH<sup>2</sup>, PHILIPP GEGENWART<sup>2</sup>, and MARTIN WENDEROTH<sup>1</sup> — <sup>1</sup>IV. Physikalisches Institut, Georg-August Universität Göttingen, Germany — <sup>2</sup>Lehrstuhl für Experimentalphysik VI, Zentrum für Elektronische Korrelationen und Experimentalphysik, Universität Augsburg, Germany

The correlated honeycomb transition metal oxides attract large attention for the theoretical prospect of topological non-triviality as well as being a possible realization of the magnetic Kitaev exchange model. The Mott insulating sodium iridate Na<sub>2</sub>IrO<sub>3</sub> is prototypical among these materials with the potential to bridge the field of strongly correlated systems with topology [1]. By using home-built STM and STS combined with macroscopic conductivity measurements of freshly cleaved Na<sub>2</sub>IrO<sub>3</sub> surfaces in UHV we measure the properties provided by the sample surface. We report on the rather unconventional linear-dispersion in-gap conductivity found by tunneling spectroscopy. The addressability of such states strongly depends on the electronic properties of the probe and local surface structures. We will further discuss the found conductivity of the Na<sub>2</sub>IrO<sub>3</sub> surface in the light of macroscopic measurements, complementing previous (bulk) results [2]. We

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References: [1] *Phys. Rev. B* 91, 041405(R) (2015), [2] *Phys. Rev. B* 82, 064412 (2010)

O 64.4 Wed 10:30 P

**Surface electronic structure of CsSnBr<sub>3</sub> perovskite** — ●JONAS HAUNER, JANEK RIEGER, DANIEL NIESNER, and THOMAS FAUSTER — Friedrich-Alexander-Universität, Erlangen, Deutschland

Lead and tin halide based semiconductors with the perovskite structure show high dynamic disorder, i.e. local and instantaneous deviations from the ideal perovskite structure. These are expected to be larger for tin than for lead halide perovskites. Resulting local orientation of electric dipoles may drive unusual physical phenomena like dynamical Rashba or polaronic effects. While lead-based compounds are studied extensively, reports of tin-based compound surfaces are limited. We carried out angle-resolved photoelectron spectroscopy and two-photon photoelectron spectroscopy (2PPE) on (001) surfaces of CsSnBr<sub>3</sub>. The valence band maximum is found close to the Fermi level and thus the surfaces are p-doped. The valence band dispersion is consistent with a hole effective mass of  $m^* < 0.2 m_e$ . Two unoccupied states are found by 2PPE.

O 64.5 Wed 10:30 P

**Surface atomic and electronic structure of CsPbBr<sub>3</sub>** — ●JANEK RIEGER, TILMAN KISSLINGER, M. ALEXANDER SCHNEIDER, THOMAS FAUSTER, and DANIEL NIESNER — Lehrstuhl für Festkörperphysik, Friedrich-Alexander University Erlangen-Nürnberg (FAU), Staudtstr. 7, D-91058 Erlangen, Germany

Lead-halide-based semiconductors with the perovskite structure (LHPs) and the empirical formula ABX<sub>3</sub> (where A = Cs, CH<sub>3</sub>NH<sub>3</sub>, B = Pb and X = I, Br, Cl) tend to form stable (001) surfaces, which can exhibit AX and BX<sub>2</sub> surface terminations. A giant Rashba splitting of the valence bands backfolded to the  $\bar{\Gamma}$  point could be observed for the BX<sub>2</sub> termination, but not for the AX-terminated surfaces of organic-inorganic LHPs (A = CH<sub>3</sub>NH<sub>3</sub>) [1].

For a systematic study of the interplay between surface atomic and electronic structure of purely inorganic LHPs, we carried out low-energy electron diffraction (LEED), scanning tunneling microscopy (STM) and angle-resolved photoelectron spectroscopy (ARPES) on CsPbBr<sub>3</sub>. From our STM and LEED results we can identify the prevalence of two different surface terminations for different preparations. The different terminations exhibit distinct spectral features in photoemission spectroscopy. ARPES results indicate no Rashba splitting and no band backfolding of the valence bands for the CsBr termination in line with earlier observations [2].

[1] J. Yang et al., *Phys. Rev. B* 102, 245101 (2020).[2] M. Puppini et al., *Phys. Rev. Lett.* 124, 206402 (2020).

O 64.6 Wed 10:30 P

**Strong anisotropy in the ballistic transport regime on Pd(110)** — ●MARKUS LEISEGANG, ROBERT SCHINDHELM, JENS KÜGEL, and MATTHIAS BODE — Experimentelle Physik 2, Physikalisches Institut, Universität Würzburg

Atomic-scale charge transport is not only of significant fundamental interest but also highly relevant for numerous technical applications. However, experimental methods which are capable of detecting charge transport at the relevant single digit nanometer length scales are scarce. Here we report on molecular nanoprobe (MONA) [1] experiments on Pd(110) where we utilize the charge carrier-driven switching of a single cis-2-butene molecule [2] to detect ballistic transport properties over length scales of a few nanometers. Our data demonstrate a striking angular dependence with a dip in charge transport along the [1-10]-oriented atomic rows and a peak in the transverse [001] direction. The narrow angular width of both features and distance-dependent measurements suggest that the nanometer-scale ballistic transport properties of metallic surfaces are significantly influenced by the atomic structure.

[1] M. Leisegang et al. *Nano Letters* 18, 2165-2171 (2018)[2] Y. Sainoo et al. *Phys. Rev. Lett.* 95, 246102 (2005)