

## KOND

Monday, 27.06.2022, Room JD 002

Time	ID	KOND I: CHARGE DENSITY WAVES AND STRONGLY CORRELATED SYSTEMS Chair: Henrik Rønnow, EPFL
16:30	101	<p><b>Modified copper charge density wave (Cu-CDW) order in <math>\text{YBa}_2\text{Cu}_3\text{O}_7 / \text{Nd}_{1-x}(\text{Ca}_{1-y}\text{Sr}_y)_x\text{MnO}_3</math> heterostructures</b></p> <p><i>Subhrangsu Sarkar<sup>1</sup>, Roxana Gaina Capu<sup>1,2</sup>, Jarji Khmaladze<sup>1</sup>, Mathias Soulier<sup>1</sup>, Edith Perret<sup>1,3</sup>, Claude Monney<sup>1</sup>, Thorsten Schmitt<sup>4</sup>, Cinthia Piamonteze<sup>4</sup>, Eugen Weschke<sup>5</sup>, Christian Bernhard<sup>1</sup></i></p> <p><sup>1</sup> University of Fribourg, <sup>2</sup> University of Timisoara, Romania, <sup>3</sup> EMPA, St. Gallen, <sup>4</sup> Paul Scherrer Institut, <sup>5</sup> Helmholtz-Zentrum Berlin für Materialien und Energie, BESSY II</p> <p>Using RIXS and REXS, we measured the systematic modification of Cu-charge density wave in optimally doped <math>\text{YBa}_2\text{Cu}_3\text{O}_7</math>, under the interfacial proximity of <math>\text{Nd}_{1-x}(\text{Ca}_{1-y}\text{Sr}_y)_x\text{MnO}_3</math> as function of the hole doping and tolerance factor of the manganite layers.</p> <p>For <math>x = 0.35</math>, we observe the Cu-CDW order with the usual dx<sup>2</sup>-y<sup>2</sup> orbital character at <math>Q_{\parallel} = 0.3</math> r.l.u., which gets strongly enhanced as the tolerance factor of the manganite layers is decreased or when a strong magnetic field is applied.</p> <p>For <math>x = 0.5</math> and <math>y = 0.25</math>, we observe a completely new kind of Cu-order which has a small wave vector of <math>Q_{\parallel} = 0.1</math> r.l.u., a much larger correlation length of about 40 nm and a completely different dz<sup>2</sup> orbital character.</p>
17:00	102	<p><b>Stacking Order Induced Metallic State at the Surface of Untreated 1T-TaS<sub>2</sub></b></p> <p><i>Björn Salzmann<sup>1</sup>, Elina Hujala<sup>1</sup>, Christopher Nicholson<sup>1</sup>, Catherine Witteveen<sup>2</sup>, Fabian von Rohr<sup>2</sup>, Helmuth Berger, Baptiste Hildebrand<sup>1</sup>, Claude Monney<sup>1</sup></i></p> <p><sup>1</sup> University of Fribourg, <sup>2</sup> University of Zürich</p> <p>Tantalum disulphide (1T-TaS<sub>2</sub>) is a layered material which hosts an insulating commensurate charge density wave (CCDW) at temperatures below ~165 K. Recent investigations of 1T-TaS<sub>2</sub> have revealed the existence of a metastable metallic phase accessible from this CCDW phase by applying a laser- or current pulse. Here we present Scanning Tunnelling Microscopy and Spectroscopy (STM/STS) measurements on 1T-TaS<sub>2</sub> surfaces not exposed to such pulses which show the same metallic behaviour as the pulse induced phase over distances of hundreds of nanometres. Further analysis shows evidence of a change in top layer stacking in the metallic phase, in agreement with recent theoretical and experimental works.</p>
17:15	103	<p><b>Magnon excitations in the metallic kagome ferromagnet Fe<sub>3</sub>Sn<sub>2</sub></b></p> <p><i>Wenliang Zhang<sup>1</sup>, Yi Tseng<sup>1</sup>, Teguh Citra Asmara<sup>1</sup>, Thorsten Schmitt<sup>1</sup>, Yona Soh<sup>1</sup>, Gabriel Aeppli<sup>1,2,3</sup></i></p> <p><sup>1</sup> Paul Scherrer Institut, <sup>2</sup> ETH Zürich, <sup>3</sup> EPFL</p> <p>The metallic kagome ferromagnet Fe<sub>3</sub>Sn<sub>2</sub>, which shows large spin-orbital coupling, hosts various exotic electronic/magnetic states, including flat electronic bands, massive Dirac fermions, and field-tunable nematicity. While most studies focus on the electronic degree of freedom, investigations of the spin excitations are scarce. Here we studied the character of the low-energy excitations in Fe<sub>3</sub>Sn<sub>2</sub> by exploiting magnetic circular dichroism (MCD) in Resonant Inelastic X-Ray Scattering (RIXS). With the selection-rule analysis, spin-wave excitations are identified with a flat band and a dispersive acoustic band. Our results unveil the nature of the spin dynamics in Fe<sub>3</sub>Sn<sub>2</sub>, and present a new way to study the spin excitations in ferromagnetic materials by RIXS MCD.</p>

17:30	104	<p style="text-align: center;"><b>Physics of the RENiO<sub>3</sub> single crystals (RE = Nd, Sm, Gd, Dy, Y, Ho, Er, Lu) below T<sub>Néel</sub>*</b></p> <p style="text-align: center;"><i>Dariusz Jakub Gawryluk<sup>1</sup>, Yannick Maximilian Klein<sup>1</sup>, Mirosław Kozłowski<sup>2</sup>, Anthony Linden<sup>3</sup>, Marisa Medarde<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> <i>Laboratory for Multiscale Materials Experiments, Paul Scherrer Institut, CH-5232 Villigen PSI</i>  <sup>2</sup> <i>Łukasiewicz Research Network Tele &amp; Radio Research Institute</i>  <sup>3</sup> <i>Department of Chemistry, University of Zürich</i></p> <p>RENiO<sub>3</sub> perovskites are a handbook example of strongly correlated system, where interplay between, lattice, charge, and spin degrees of freedom leads to spontaneous metal-insulator transition. The electronic localization is associated with a charge redistribution and subtle structural distortions. Recently, intriguing phenomena like non-centrosymmetric antiferromagnetic ordering or multiferroelectricity have been theoretically predicted in the system. However, drawback for the advancement in the nickelates physics has been lack of single crystals, which limited amount of experiments needed for validation of predictions. We achieved RENiO<sub>3</sub> crystals by applying the solvothermal method in temperature gradient under high-oxygen-pressure, which have opened new opportunities to go beyond known up-to-date physics of the family.</p>
17:45	105	<p style="text-align: center;"><b>High-density Carrier Dynamics in Perovskite Wide-Bandgap Oxide</b></p> <p style="text-align: center;"><i>Hui-Yuan Chen<sup>1</sup>, Rolf B. Versteeg<sup>1</sup>, David P. Santos-Cottin<sup>2</sup>, Xuan Luo<sup>3</sup>, Renhui Wei<sup>3</sup>, Ana Akrap<sup>2</sup>, Majed Chergui<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> <i>Laboratory of Ultrafast Spectroscopy, EPFL, CH-1015 Lausanne</i>  <sup>2</sup> <i>Light Fermion Spectroscopy, University of Fribourg, CH-1700 Fribourg</i>  <sup>3</sup> <i>Institute of Solid State Physics, Chinese Academy of Sciences, Hefei, Anhui 230031, P.R.C.</i></p> <p>Wide bandgap oxides (WBGs) have exhibited superior material properties for power electronics and optoelectronics. However, transient electronic dynamics right after high-density carrier injection into the conduction band of WBGs has not been fully understood. In this study, we achieved transient carrier injection in a simple cubic perovskite WBG via ultrafast above-gap photoexcitation and revealed its sub-picosecond carrier dynamics across the bandgap. A fast hot-carrier cooling lifetime of 1 ps due to electron-phonon scattering along with clear exciton bleach and excitonic enhancement resulting from photo-excited free carriers are unveiled. The collective carrier behaviour under many-body interactions in this study provides fundamental information to investigate the underlying physics in perovskite WBGs.</p>
18:00	106	<p style="text-align: center;"><b>Impact of growth conditions on the optoelectronics applications of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub>, studied by low-energy <math>\mu</math>SR</b></p> <p style="text-align: center;"><i>Xiaojie Ni<sup>1</sup>, Lei Lei<sup>2</sup>, Maria Iñes Mendes Martins<sup>1</sup>, Zaher Salman<sup>1</sup>, Andreas Suter<sup>1</sup>, Thomas Prokscha<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> <i>Paul Scherrer Institute,</i> <sup>2</sup> <i>University of Nottingham</i></p> <p>Metal halide perovskites (MHPs) have attracted great attention in recent years due to their enormous potential for application in optoelectronic devices. However, the defects at surface / interfaces and grain boundaries of perovskite films, which impede the further enhancement of power conversion efficiency (PCE) and long-term stability of halide perovskite solar cells (PSCs), still need to be fully understood. Here, we studied the effect of different growth conditions on the interface and grain boundaries of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite films by low-energy <math>\mu</math>SR.</p>
18:15	107	<p style="text-align: center;"><b>Spectroscopic investigation of charge density wave in TiSe<sub>2</sub> flakes</b></p> <p style="text-align: center;"><i>Grazia Raciti<sup>1</sup>, Begoña Abad<sup>1</sup>, Marta de Luca<sup>1</sup>, P. Alonso-González<sup>2</sup>, A. Martínez-Suárez<sup>2</sup>, Javier Martín-Sánchez<sup>2</sup>, Ilaria Zardo<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> <i>Departement Physik, Universität Basel, 4056 Basel</i>  <sup>2</sup> <i>Departimento de Física, Universidad de Oviedo, Spain</i></p> <p>TiSe<sub>2</sub> is a transition metal dichalcogenide materials that exhibits charge density wave (CDW) phase transition below T <math>\approx</math> 200 K. The CDW formation is associated to a structural distortion of the lattice into a new one whose Brillouin zone size is halved. We present a Raman spectroscopy-based approach to determine the CDW transition temperature (T<sub>CDW</sub>) of exfoliated TiSe<sub>2</sub> onto Si/SiO<sub>2</sub>, upon different film thicknesses. The aim of this work is to investigate the relationship between the T<sub>CDW</sub> and the thickness of the TiSe<sub>2</sub> flakes and to further explore its correlation with the layer number parity.</p>

18:30		
19:30		<b>Public Lecture</b>

**Tuesday, 28.06.2022, Room JD 002**

Time	ID	<b>KOND II: 2D SYSTEMS</b> <i>Chair: Johan Chang, Universität Zürich</i>
14:00	111	<p><b>A strong and electrically tunable optical resonance in a two-dimensional semiconductor</b></p> <p><i>Nadine Leisgang, Departement Physik, Universität Basel</i></p> <p>Atomically thin transition metal dichalcogenides, such as molybdenum disulfide (<math>\text{MoS}_2</math>), are promising candidates for opto-electronic devices because of their intrinsically strong light-matter interaction. However, excitons in monolayer <math>\text{MoS}_2</math> are not electrically tunable due to their limited out-of-plane extend, leading to a minimal electric dipole moment. We engineered a tunable system using bilayer <math>\text{MoS}_2</math> in a gated van der Waals heterostructure, where the vertical separation of the electron and hole leads to a large dipole moment. By applying a voltage to the electrodes, we generated an electric field that tunes the absorption of the two <math>\text{MoS}_2</math> layers. This approach combines the large oscillator strength with high electrical tunability.</p>
14:30	112	<p><b>Simultaneous Measurement of Quasiparticle Interference and Decay Length of 2D Quantum Materials with the Scanning Tunneling Microscope</b></p> <p><i>Berk Zengin, Fabian Natterer, Danyang Liu, Kevin Hauser, University of Zurich</i></p> <p>Recent advances in signal processing enable the fundamentally faster measurement of the current-voltage characteristic for tunneling spectroscopy through the parallel demodulation of higher harmonics that are produced from nonlinearities in the tunneling junction. The local density of states (LDOS) can thus be measured in a few milliseconds. Here, we use the fast spectroscopy for quasiparticle interference imaging not only at a fixed tunneling impedance but also measure the LDOS for varying tip-sample separations. From the tip-height dependent I-V measurements, we obtain voltage dependent decay length measurements in an energy interval previously inaccessible.</p>
14:45	113	<p><b>Quantitative Magnetometry on Nanostructured MBE Grown 2D In-Plane Ferromagnet</b></p> <p><i>Patrick Reiser, Maerta Tschudin, David Aaron Broadway, Patrick Maletinsky, University of Basel</i></p> <p>The discovery of ferromagnetic 2D van der Waals (vdW) crystals allows the study of novel magnetic phenomena at a reduced dimensionality. While exfoliated 2D vdW crystals offer only limited control of their exact geometry, 2D magnets grown by molecular beam epitaxy (MBE) overcome this limitation. Here, we investigate the MBE grown 2D in-plane ferromagnet <math>\text{Cu}_3\text{Au}</math> on a nanostructured substrate by quantitative scanning nitrogen-vacancy magnetometry. We determine its fundamental magnetic parameters quantitatively in various geometric configurations and offer new insights into the transition from bulk properties to the 2D limit. Moreover, we provide the basis for targeted engineering of geometries to nucleate novel spin-textures and domain patterns.</p>
15:00	114	<p><b><math>\text{Cu}_3\text{Au}(111)</math> - ordering / disordering &amp; potential for cobalt island growth</b></p> <p><i>Ales Cahlik, Berk Zengin, Fabian Donat Natterer, University of Zurich</i></p> <p>The growth of thin films and nanostructures on solid surfaces is governed by the substrate structural properties and lattice matching. In this respect, metallic alloys can offer an interesting alternative to conventionally utilized pure metal substrates due to a larger flexibility in the effective lattice parameter. In our work we investigate the structural and electronic properties of <math>\text{Cu}_3\text{Au}(111)</math> surface by means of STM and nc-AFM. Furthermore, we demonstrate the crystal's potential as a substrate for the growth of cobalt islands as an alternative to <math>\text{Co/Cu}(111)</math>, for which we explore their structure and characterize their magnetic properties.</p>

15:15	115	<p style="text-align: center;"><b>Evolution of electronic configuration and spin-state in CrI<sub>3</sub>, CrBr<sub>3</sub> and CrCl<sub>3</sub></b></p> <p style="text-align: center;"><i>Yuan Wei<sup>1</sup>, Wenliang Zhang<sup>1</sup>, Teguh Citra Asmara<sup>1</sup>, Tianlun Yu<sup>1</sup>, Galdino Carlos<sup>1</sup>, Zhen Tao<sup>1</sup>, Enrico Giannini<sup>2</sup>, Thorsten Schmitt<sup>1</sup></i>  <sup>1</sup> Paul Scherrer Institute, <sup>2</sup> University of Geneva</p> <p>Layered van der Waals chromium trihalides have received growing interest in recent years due to their extraordinary electronic and magnetic properties as well as the opportunity for the development of future functional heterostructures. We investigate the electronic configuration of CrI<sub>3</sub>, CrBr<sub>3</sub>, and CrCl<sub>3</sub> by Resonant Inelastic X-ray scattering (RIXS). The temperature-dependence of the RIXS response displays the correlation between the magnetism and the electronic configuration across the magnetic transition. From charge-transfer multiplet calculations, we quantify crystal-field and the evolution of the spin-state. The spin-state transition of Cr<sup>3+</sup> is strongly coupled to changes in orbital-selective Coulomb correlations controlling the spin-orbital excitations.</p>
15:30	116	<p style="text-align: center;"><b>Mapping the excitation-specific electron, spin and lattice dynamics in spinel Co<sub>3</sub>O<sub>4</sub> thin films with fs-resolution</b></p> <p style="text-align: center;"><i>Oliviero Cannelli<sup>1</sup>, Simone Restelli<sup>2</sup>, Paolo Usai<sup>1</sup>, Charles Bevis<sup>2</sup>, Ludmila Leroy<sup>3</sup>, Camila Bacellar<sup>3</sup>, Natacha Ohannessian<sup>3</sup>, Daniele Pergolesi<sup>3</sup>, Mykola Biednov<sup>4</sup>, Hazem Yousef<sup>4</sup>, Dmitry Khakhulin<sup>4</sup>, Frederico A. Lima<sup>4</sup>, Christopher J. Milne<sup>4</sup>, Giulia Fulvia Mancini<sup>2</sup>, Majed Chergui<sup>1</sup></i>  <sup>1</sup> EPFL, <sup>2</sup> University of Pavia, <sup>3</sup> PSI, <sup>4</sup> XFEL</p> <p>We present a combined broadband transient reflectivity and femtosecond X-ray emission spectroscopic study of spinel Co<sub>3</sub>O<sub>4</sub>, a system representing a prototypical case of the intrinsic complexity of transition metal oxides, due to its correlated interaction of electronic, nuclear and spin degrees of freedom. By exciting the ligand-to-metal charge transfer and metal-to-metal charge transfer transitions of the system, we show excitation-specific coherent and incoherent photoresponses that are mediated by different electron-phonon couplings and involve distinct Cobalt electronic transient configurations. Our joint investigation rules out a stepwise cascade mechanism in the charge carrier relaxation of the material, and it presents a radically different picture compared to previous time-resolved studies of Co<sub>3</sub>O<sub>4</sub>.</p>
15:45	117	<p style="text-align: center;"><b>Characterization and analysis of a symmetry-breaking THz chiral metamaterial</b></p> <p style="text-align: center;"><i>Lorenzo Graziotto, Johan Andberger, Mattias Beck, Giacomo Scalari, Jérôme Faist</i>  <i>ETH Zürich, Institute for Quantum Electronics</i></p> <p>The ultra-strong coupling between the cyclotron resonance of a 2D electron gas in a static perpendicular magnetic field and an antenna-based metamaterial that can sustain chiral electromagnetic modes gives rise to polaritonic states with opposite circular polarizations, thus providing a way to break time-reversal symmetry. To further investigate polaritons dressed by the electromagnetic vacuum in the cavity, highly subwavelength interacting volumes along with high electron densities are needed. Therefore, planar cavities on a GaAs/AlGaAs heterostructure are engineered and characterized through THz time-domain spectroscopy, and the coupling mechanism and its limitations are understood straightforwardly via classical circuit theory.</p>
16:00	118	<p style="text-align: center;"><b>A sacrificial magnet system for field dependent surface science studies</b></p> <p style="text-align: center;"><i>Danyang Liu, Jens Opplinger, Ales Cahlik, Catherine Witteveen, Fabian von Rohr, Fabian Natterer,</i>  <i>University of Zürich</i></p> <p>We describe the design and characterization of using a NbFeB permanent magnet system to retrofit existing experiments with a magnetic field around 200 mT. The design is compatible with UHV high-temperature sample cleaning routines which are normally above the Curie temperature of a permanent magnet. We characterize the flux density distribution with superconducting vortices in NbSe<sub>2</sub> and BSCCO and demonstrate the life-cycle of the magnet from sample preparation to characterization. Our magnet provides an accessible way to field-dependent surface science studies, ranging from vortices in high-temperature superconductors to STM-enabled electron spin resonance.</p>

<b>16:15</b>	<b>119</b>	<p><b>Modulation of Band and Electronic properties of Titanate Surface / Interface</b></p> <p><i>Hang Li<sup>1</sup>, Yunzhong Chen<sup>2</sup>, Alla Chikina<sup>1</sup>, Dennis V. Christensen<sup>3</sup>, Rasmus T. Dahm<sup>3</sup>, Yulin Gan<sup>2</sup>, Eduardo Guedes<sup>1</sup>, Hugo Walber<sup>4</sup>, Marius-Adrian Husanu<sup>5</sup>, Milan Radović<sup>1</sup>, Nicholas Clark Plumb<sup>1</sup>, Nini Pryds<sup>3</sup>, Ming Shi<sup>1</sup>, Vladimir Stokov<sup>1</sup></i></p> <p><sup>1</sup> Paul Scherrer Institut, <sup>2</sup> Institute of Physics, Chinese Academy of Sciences  <sup>3</sup> Technical University of Denmark, <sup>4</sup> Universidade Federal de Minas Gerais  <sup>5</sup> National Institute of Materials Physics, Romania</p> <p>The two-dimensional electron gas (2DEG), formed at the surface/interface of oxide insulators, exhibits exotic physical properties. The modulation of electronic structures of 2DEG system are of crucial importance to control the properties. In this report, I will introduce the ARPES results on two 2DEG systems. In amorphous LaAlO<sub>3</sub>/LaMnO<sub>3</sub>/SrTiO<sub>3</sub>, the LaMnO<sub>3</sub> buffer layer significantly suppresses the formation of oxygen vacancies, and the electron-phonon interaction is reduced, explaining the mobility boost in this system. On SrTiO<sub>3</sub> surface, we discovered band modulations with in-situ sputtering-annealing, and a robust single-band 2DEG states. Meanwhile, the possible origination and mechanisms of light-induced 2DEG on SrTiO<sub>3</sub> surface are also discussed.</p>
<b>16:30</b>		<b>Coffee Break</b>
<b>19:00</b>		<b>Postersession with Apéro</b>

**Wednesday, 29.06.2022, Room JD 002**

<b>Time</b>	<b>ID</b>	<p><b>KOND III: SUPERCONDUCTIVITY</b>  <i>Chair: Subhramgsu Sarkar, Université de Fribourg</i></p>
<b>14:30</b>	<b>121</b>	<p><b>Actuation of a Superconducting Switch via Out-of-Equilibrium Electrons and Phonons</b></p> <p><i>Markus Ritter<sup>1</sup>, Nicolò Crescini<sup>1</sup>, Daniel Z. Haxell<sup>1</sup>, Manuel Hinderling<sup>1</sup>, Heike Riel<sup>1</sup>, Christoph Bruder<sup>2</sup>, Andreas Fuhrer<sup>1</sup>, Fabrizio Nichele<sup>1</sup></i></p> <p><sup>1</sup> IBM Quantum, IBM Research – Zurich, Säumerstrasse 4, CH-8803 Rüschlikon  <sup>2</sup> Department of Physics, University of Basel, Klingelbergstrasse 82, CH-4056 Basel</p> <p>Recent experiments with metallic nanowire devices suggest that superconductivity can be suppressed by the application of electric fields, at odds with current understanding of electrostatic screening in metals. We demonstrate that the control of superconductivity in such switches does not depend on the presence of an electric field at the nanowire surface but requires a current of high-energy electrons (below 100 fA in our devices). The suppression of superconductivity is most efficient when electrons are injected into the nanowire, but similar results are obtained when a current flows between two remote electrodes without electrons reaching the nanowire. In the latter case, high-energy electrons decay into out-of-equilibrium phonons which propagate through the substrate and affect superconductivity in the nanowire by generating quasiparticles.</p>

15:00	122	<p><b>Time-reversal symmetry-breaking charge order in a kagome superconductor</b></p> <p>Zurab Guguchia <sup>1</sup>, Charles Mielke III <sup>1</sup>, Debarchan Das <sup>1</sup>, Jiaxin Yin <sup>2</sup>, Hongxiong Liu <sup>3</sup>, Ritu Gupta <sup>1</sup>, Yuxiao Jiang <sup>2</sup>, Marisa Medarde <sup>4</sup>, X. Wu <sup>5</sup>, Hechang Lei <sup>6</sup>, Johan Chang <sup>7</sup>, Pengcheng Dai <sup>8</sup>, Qimiao Si <sup>8</sup>, Hu Miao <sup>9</sup>, Ronny Thomale <sup>10</sup>, Titus Neupert <sup>7</sup>, Youguo Shi <sup>11</sup>, Rustem Khasanov <sup>1</sup>, Zahid M. Hasan <sup>2</sup>, Hubertus Luetkens <sup>1</sup></p> <p><sup>1</sup> Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institut, CH-5232 Villigen PSI  <sup>2</sup> Laboratory for Topological Quantum Matter and Advanced Spectroscopy (B7), Department of Physics, Princeton University, Princeton, New Jersey 08544, USA  <sup>3</sup> Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China  <sup>4</sup> Laboratory for Multiscale Materials Experiments, Paul Scherrer Institut, CH-5232 Villigen PSI  <sup>5</sup> Max-Planck-Institut für Festkörperforschung, Heisenbergstrasse 1, DE-70569 Stuttgart  <sup>6</sup> Department of Physics and Beijing Key Laboratory of Optoelectronic Functional Materials and Micro-nano Devices, Renmin University of China, Beijing 100872, China  <sup>7</sup> Physik-Institut, Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich  <sup>8</sup> Department of Physics and Astronomy, Rice University, Houston, Texas 77005, USA  <sup>9</sup> Material Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA  <sup>10</sup> Institut für Theoretische Physik und Astrophysik, Universität Würzburg, DE-97074 Würzburg  <sup>11</sup> School of Physical Sciences, University of Chinese Academy of Sciences, Beijing 100190, China</p> <p>The kagome lattice, the most prominent structural motif in quantum physics, benefits from inherent nontrivial geometry to host diverse quantum phases. We utilized muon-spin relaxation to probe charge order and superconductivity in kagome superconductors (K,Rb)V<sub>3</sub>Sb<sub>5</sub> [1]. We observe a striking enhancement of the internal field width sensed by the muon ensemble, which takes place just below the charge ordering temperature. We further show a multigap and nodal [2] superconductivity in (K,Rb)V<sub>3</sub>Sb<sub>5</sub>. Our results point to time-reversal symmetry-breaking charge order intertwining with unconventional superconductivity in the correlated kagome lattice, offering unique insights into the pairing mechanism.</p> <p>[1] C. Mielke III et al., and Z. Guguchia, Nature 602, 245-250 (2022).  [2] Z. Guguchia et al., arXiv:2202.07713v1 (2022).</p>
15:15	123	<p><b>Boosting charge stripe order by uniaxial pressure</b></p> <p>Julia Küspert <sup>1</sup>, Ruggero Frison <sup>1</sup>, Qisi Wang <sup>1</sup>, Alexander Morawietz <sup>1</sup>, Oleh Ivashko <sup>2</sup>, Martin von Zimmermann <sup>2</sup>, Daniel Mazzone <sup>3</sup>, Marc Janoschek <sup>3</sup>, Jaewon Choi <sup>4</sup>, Izabela Bialo <sup>1</sup>, Tohru Kurosawa <sup>5</sup>, Naoki Momono <sup>6</sup>, Migaku Oda <sup>5</sup>, Johan Chang <sup>1</sup></p> <p><sup>1</sup> Physik-Institut, Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich  <sup>2</sup> DESY, PETRA III, <sup>3</sup> Paul Scherrer Institute  <sup>4</sup> Diamond Light Source, <sup>5</sup> Hokkaido University, <sup>6</sup> Muroran Institute of Technology</p> <p>High-temperature superconducting cuprates are an excellent model system to study the relationship between intertwined quantum phases. We aimed to influence the competition between superconductivity and charge order in La<sub>2-x</sub>Sr<sub>x</sub>CuO<sub>4</sub> (LSCO) by applying strain along the tetragonal <i>c</i>-axis direction, tuning the next-nearest neighbour hopping strength. X-ray diffraction measurements were performed at DESY to track charge order at different temperatures, dopings, and magnetic fields. Our results suggest, that <i>c</i>-axis strain drives the system closer to the state achieved with magnetic field. So, it stabilizes the charge ordered state while superconductivity is weakened, providing a fruitful approach to study the interplay between the two phenomena in the cuprates.</p>
15:30	124	<p><b>Infrared response of the telephone number compound Sr<sub>2</sub>Ca<sub>12</sub>Cu<sub>24</sub>O<sub>41</sub></b></p> <p>Christian Bernhard <sup>1</sup>, Bing Xu <sup>1</sup>, Petr Adamus <sup>2</sup>, Dominik Munzar <sup>2</sup>, Pascal Puphal <sup>3</sup>, Ekaterina Pomjakushina <sup>3</sup></p> <p><sup>1</sup> Department of Physics, University of Fribourg  <sup>2</sup> Department of Condensed Matter Physics, Faculty of Science, Masaryk University  <sup>3</sup> Laboratory for Developments and Methods, Paul Scherrer Institut</p> <p>We compare the infrared responses of the underdoped cuprate superconductor YBa<sub>2</sub>Cu<sub>3</sub>O<sub>6.6</sub> and the so-called telephone-number-compound Sr<sub>2</sub>Ca<sub>12</sub>Cu<sub>24</sub>O<sub>41</sub>. The charge carriers of the latter reside in layers of weakly coupled two-leg ladders. The response of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>6.6</sub> was previously shown to exhibit a characteristic pseudogap and precursor superconducting pairing that develop well above T<sub>c</sub> [1]. The infrared spectra of</p>

		<p><math>\text{Sr}_2\text{Ca}_{12}\text{Cu}_{24}\text{O}_{41}</math> reveal surprisingly similar features. A pseudogap appears here along the rungs and signatures of pair formation are seen along the legs of the ladders. This analogy provides evidence in favor of a stripe-like electronic structure of <math>\text{YBa}_2\text{Cu}_3\text{O}_6</math> and other high-<math>T_c</math> cuprates.</p> <p>[1] A. Dubroka et al., Phys. Rev. Lett. 106, 047006 (2011).</p>
15:45	125	<p><b>Possible p-wave parity in newly found superconductor <math>\text{Pr}_3\text{Cr}_{10-x}\text{N}_{11}</math></b></p> <p><i>Changsheng Chen<sup>1</sup>, Wei Wu<sup>2</sup>, Cheng Tan<sup>3</sup>, Zihao Zhu<sup>3</sup>, Yanxing Yang<sup>3</sup>, Adrian Hillier<sup>4</sup>, Jianlin Luo<sup>2</sup>, Lei Shu<sup>3</sup></i></p> <p><sup>1</sup> University of Zürich</p> <p><sup>2</sup> Beijing National Laboratory for Condensed Matter Physics and Institute of Physics, Chinese Academy of Sciences</p> <p><sup>3</sup> State Key Laboratory of Surface Physics and Department of Physics, Fudan University</p> <p><sup>4</sup> ISIS Facility, STFC Rutherford Appleton Laboratory, Harwell Science and Innovation Campus</p> <p>Superconductivity with a critical temperature <math>T_c \sim 5.25</math> K was recently reported in the Cr-based superconductor <math>\text{Pr}_3\text{Cr}_{10-x}\text{N}_{11}</math>. The large upper critical field <math>H_{c2} \sim 20</math> T, and the strong correlation between 3d electrons derived from specific heat, suggest the unconventional superconductivity nature of this compound. We performed muon-spin rotation/relaxation (<math>\mu\text{SR}</math>) measurements on a high-quality polycrystalline of <math>\text{Pr}_3\text{Cr}_{10-x}\text{N}_{11}</math>, down to 0.027 K, and specific heat measurements under different magnetic fields up to 9 Tesla. Our <math>\mu\text{SR}</math> data indicate that time-reversal symmetry is broken in the superconducting state of <math>\text{Pr}_3\text{Cr}_{10-x}\text{N}_{11}</math>, and the superconducting energy gap is consistent with a p-wave model, which is also supported by the specific heat data.</p>
16:00	126	<p><b>Superconductivity in simple cubic phosphorus: The role of dynamical screening and electronic correlations</b></p> <p><i>Viktor Christiansson, Francesco Petocchi, Philipp Werner, University of Fribourg</i></p> <p>Experimentally simple cubic phosphorus displays a peculiar pressure-<math>T_c</math> curve with valley- and ridge-like features between 12 and 50 GPa. From the theoretical side, a simple electron-phonon mechanism proves insufficient to describe this behaviour. To address possible effects coming from electronic correlations and plasmonic contributions we have solved the parameter free gap equation of density functional theory for superconductors. We find that an electron-electron interaction kernel obtained from a one-shot GW calculation predicts values of <math>T_c</math> in the correct range. Additionally including a correction of the band structure from the quasi-particle energies significantly improves <math>T_c</math> in the high-pressure region.</p>
16:15	127	<p><b>Laser ARPES on <math>\text{Fe}_3\text{Sn}_2</math>: Untangling twin domains and discovery of unconventional quasiparticle</b></p> <p><i>Sandy Adhithia Ekahana<sup>1</sup>, Gabriel Aeppli<sup>1,2,3</sup>, Yona Soh<sup>1</sup>, Anna Tamai<sup>4</sup></i></p> <p><sup>1</sup> Paul Scherrer Institut, <sup>2</sup> ETH Zürich, <sup>3</sup> EPFL, <sup>4</sup> Université de Genève</p> <p>Kagome materials have attracted much interest recently as they may host topological bands, flat bands, superconductivity, unconventional magnetic properties, etc. In this talk, we present our work on one example of magnetic Weyl kagome material called <math>\text{Fe}_3\text{Sn}_2</math> by using laser micro-ARPES. With a small spatial resolution of a few microns of the laser, we show that the breathing kagome pattern in <math>\text{Fe}_3\text{Sn}_2</math> manifests itself in twin domains that are otherwise unresolved in conventional synchrotron-based ARPES experiments. From these untangled twinned areas, we analyzed the electron pockets at the zone center and discover the band characteristic follows the marginal Fermi liquid hypothesis indicating a break from a Fermi liquid picture.</p>
16:30		<b>Coffee Break</b>
19:00		<b>Transfer to Dinner</b>
19:30		<b>Conference Dinner</b>

Time	ID	<b>KOND IV: THEORY</b> <i>Chair: Ilaria Zardo, Universität Basel</i>
14:15	131	<p style="text-align: center;"><b>Nonunitary Superconductivity in Complex Quantum Materials</b></p> <p style="text-align: center;"><i>Aline Ramires, Paul Scherrer Institute</i></p> <p>The generalization of the notion of nonunitary superconductivity to complex materials with multiple internal degrees of freedom (such as orbitals, sublattices, or layers) opens multiple possibilities. Focusing on d-electron systems with two orbitals, we can address a variety of complex quantum materials and discuss the consequences for the superconducting spectra. In particular, gap openings of band crossings at finite energies can be attributed to a nonunitary order parameter if this is associated with a finite superconducting fitness measure. We speculate that nonunitary superconductivity in complex quantum materials is very common and can be associated with multiple cases of time-reversal symmetry breaking superconductors.</p>
14:45	132	<p style="text-align: center;"><b>Recognizing the face of wave functions</b></p> <p style="text-align: center;"><i>Augustin Muster<sup>1</sup>, Geoffroy J. Aubry<sup>2</sup>, Luis S. Froufe-Pérez<sup>1</sup></i>  <sup>1</sup> University of Fribourg, <sup>2</sup> Institut de Physique de Nice, Université Côte d'Azur and CNRS</p> <p>Transport of electromagnetic waves in 2D disordered hyperuniform structures shows an interesting behavior. Indeed, at least 5 different transport regimes have been recognized, like Anderson localization or diffusion. A traditionally used method to determine the transport regime associated with a wave function is the inverse participation ratio. Unfortunately, this method leads to inconclusive results in this type of systems. To remedy this, a convolutional neural network is trained in order to predict wave functions transport regimes. We discuss the high prediction accuracy of the network and its generalization capability on similar systems.</p>
15:00	133	<p style="text-align: center;"><b>Vertex impurity solver based on strong-coupling diagrammatic expansion</b></p> <p style="text-align: center;"><i>Aaram J. Kim<sup>1</sup>, Martin Eckstein<sup>2</sup>, Katharina Lenk<sup>2</sup>, Jiajun Li<sup>1,3</sup>, Philipp Werner<sup>1</sup></i>  <sup>1</sup> University of Fribourg, <sup>2</sup> University of Erlangen-Nürnberg, <sup>3</sup> Paul Scherrer Institute</p> <p>We present a new diagrammatic Monte Carlo impurity solver based on the strong-coupling expansion of the vertex functions. By directly sampling the four-point pseudo-particle vertex diagrams and applying the self-consistency equation at the level of the triangular vertex, we significantly improve the traditional schemes such as non-crossing approximation, and achieve numerically exact results. We analyse the performance and the convergence rate of the impurity solver using exactly solvable models and observe that the efficiency of the vertex self-consistent scheme strongly depends on the particle statistics of the bath degrees of freedom. We discuss the physics of strong light-matter coupling in the spin-boson model representing an emitter in an optical waveguide.</p>
15:15	484	<p style="text-align: center;"><b><del>Statistical Physics Through the Lens of Real-Space Mutual Information</del></b></p> <p style="text-align: center;"><del><i>Georg-Erik Schkonek<sup>1</sup>, Zohar Ringel<sup>1</sup>, Sebastian Huber<sup>1</sup>, Masroor Kooli-Jassar<sup>2</sup></i></del>  <del><sup>1</sup>ETH Zürich, <sup>2</sup>The Hebrew University of Jerusalem, <sup>3</sup>University of Chicago</del></p> <p><del>Identifying relevant source degrees of freedom in a complex system is a key stage in developing effective theories. The renormalisation group provides a framework for this, but its practical execution in unfamiliar systems is fraught with ad-hoc choices, whereas machine learning approaches, though promising, often lack formal interpretability. Recently, the optimal source ranking rule was shown to be determined by a universal but computationally difficult information-theoretic principle. Here we present the RSMI-ME algorithm employing state-of-art results in ML-based estimation of information-theoretic quantities, overcoming these computational challenges. We use it to develop a new paradigm in identifying the most relevant operators and their symmetries, conceptually paving the way towards automated theory building.</del></p> <p style="text-align: right;"><i>cancelled</i></p>

15:30	135	<p style="text-align: center;"><b>A theory for the statistics of slip at a frictional interface: unifying rate-and-state and depinning approaches</b></p> <p style="text-align: center;"><i>Tom de Geus, Matthieu Wyart, Institute of Theoretical Physics, EPFL</i></p> <p>Laws of friction have been studied since 500 years, yet their microscopic underpinning still eludes us. We do not understand how slip events are nucleated, nor what controls the distribution of their magnitude; questions that are central in earthquake science. We provide a novel framework to capture these phenomena by considering how continuum descriptions (rate-and-state laws) are perturbed by disorder. It predicts the existence of power-law distributed slip events whose size diverges at a critical stress, and that nucleate global slip if they extend past a critical length. We confirm these predictions in a minimal model of a frictional interface.</p>
15:45	136	<p style="text-align: center;"><b>Critical Behaviour and Closing Gap Issue within Realistic Noisy Variational State Preparation</b></p> <p style="text-align: center;"><i>Nikita Astrakhantsev, Giuseppe Carleo, EPFL</i></p> <p>Preparation of quantum states in form of a variational quantum circuit plays a crucial role in quantum computing. We show that, in addition to circuit architecture, the fidelity of the prepared state depends non-trivially on the number of circuit shots <math>N_s</math> used in gradient descent. Namely, we observe that fidelity shows a critical behavior in <math>N_s</math>, giving rise to the notion of critical effective temperature, below which, the resource demand of optimization grows as <math>1 \sim \Delta^2</math> with the system gap. We analyze the effect of this dependence on the of large-scale simulations of frustrated magnets and provide a symmetry-enhanced simulation protocol reducing the computational costs in near-term quantum computers.</p>
16:00	137	<p style="text-align: center;"><b>Hardware-Tailored Diagonalization Circuits</b></p> <p style="text-align: center;"><i>Daniel Miller, Laurin Fischer, Igor Sokolov, Panagiotis Barkoutsos, Ivano Tavernelli IBM Quantum, IBM Research Europe</i></p> <p>A subroutine of many quantum algorithms is the diagonalization of Pauli operators. Although it is always possible to construct a quantum circuit that simultaneously diagonalizes commuting Pauli operators, only resource-efficient circuits are reliably executable on near-term quantum computers. Generic circuits lead to a Swap-gate overhead on quantum devices with limited connectivity. A common alternative is excluding two-qubit gates which comes at the cost of restricting the class of diagonalizable sets to tensor product bases (TPBs). Here, we introduce a framework for constructing hardware-tailored (HT) diagonalization circuits. We group the Pauli operators occurring in the decomposition of popular Hamiltonians into jointly-HT-diagonalizable sets and observe that our approach can outperform conventional approaches.</p>
16:15	<b>Coffee Break</b>	
<b>KOND V: CORRELATED STATES AND TRANSITIONS</b> <i>Chair: Ilaria Zardo, Universität Basel</i>		
16:45	141	<p style="text-align: center;"><b>New perspective on unconventional superconductivity, strange metallicity, and fractional quantum Hall effect from quantum geometry</b></p> <p style="text-align: center;"><i>Alexander Kruchkov, EPFL IPHYS, 1015 Lausanne</i></p> <p>A few years ago [1], it was proposed that materials hosting narrow topological bands can support nontrivial superfluid weight, with <math>T_c</math> beyond the conventional BCS limits. This behavior roots to the large spread of electronic orbitals in topological bands, which is linked to properties of quantum metrics associated with electronic Bloch states [2,3]. We present a new perspective for quantum transport in flat band materials, adding strange metallicity, anomalous Hall conductance, fractional quantum Hall effect, thermoelectricity, and quantum noise, — to a common denominator from the quantum-geometric point of view.</p> <p>[1] S. Peotta, P. Törmä, Nature Commun. 6, 8944 (2015). [2] N. Marzari, D. Vanderbilt, Phys. Rev. B 56, 12847 (1997). [3] A. Kruchkov, Phys. Rev. B 105, L241102 (2022).</p>

17:15	142	<p style="text-align: center;"><b>Modifying the integer quantum Hall effect with cavity vacuum fields</b></p> <p style="text-align: center;"><i>Josefine Enkner<sup>1</sup>, Felice Appugiese<sup>1</sup>, Gian-Lorenzo Paravicini-Bagliani<sup>1</sup>, Mattias Beck<sup>1</sup>, Christian Reichl<sup>2</sup>, Werner Wegscheider<sup>2</sup>, Giacomo Scalari<sup>1</sup>, Cristiano Ciuti<sup>3</sup>, Jérôme Faist<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> ETH Zürich, Institute for Quantum Electronics <sup>2</sup> ETH Zürich, Laboratory for Solid State Physics <sup>3</sup> Université de Paris, MPQ</p> <p>We observe how vacuum cavity fields modify magneto-transport in the integer quantum Hall effect. In particular, odd filling factors lose their quantization, while fractional states remain intact. We quantitatively describe this loss of quantization as vacuum field induced resistivity. In our interpretation the interaction with vacuum fields adds a long range perturbation to the system, making it possible for electrons to scatter in between edge and bulk states via an intermediate state containing a virtual particle. This process ultimately breaks the topological protection of the edge states.</p>
17:30	143	<p style="text-align: center;"><b>Endofullerene Conformation from x-ray absorption</b></p> <p style="text-align: center;"><i>Wei Chuang Lee<sup>1</sup>, Ryunosuke Sagehashi<sup>1</sup>, Alexey P. Popov<sup>2</sup>, Yang Zhang<sup>2</sup>, Bernard Delley<sup>3</sup>, Matthias Muntwiler<sup>3</sup>, Thomas Greber<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> University of Zürich <sup>2</sup> Leibniz-Institute for Solid State and Materials Research (IFW), Dresden, Germany <sup>3</sup> Paul Scherer Institute</p> <p>Endofullerenes are candidate systems for molecular spintronics and electronics. Ho<sub>3</sub>N@C<sub>80</sub> has been studied using x-ray absorption spectroscopy (XAS) at different temperatures with a low noise Everhart-Thornley detector at the PEARL beamline of the Swiss Light Source. Molecules were airbrushed on a graphene substrate, then introduced into vacuum and annealed. X-ray photoelectron spectroscopy indicates a monolayer of molecules. XAS at the Ho M45 edge is performed at different temperatures with per mille accuracy. Multiplet theory predicts the spectra as a function of the orientation of the plane spanned by the three Ho atoms in the molecules.</p>
17:45	144	<p style="text-align: center;"><b>Doping asymmetry and layer-selective metal-insulator transition in trilayer K<sub>3+x</sub>C<sub>60</sub></b></p> <p style="text-align: center;"><i>Changming Yue<sup>1</sup>, Yusuke Nomura<sup>2</sup>, Philipp Werner<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> Department of Physics, University of Fribourg, <sup>2</sup> RIKEN Center for Emergent Matter Science</p> <p>K<sub>3+x</sub>C<sub>60</sub> film exhibits Mott transitions and superconductivity, depending on dimensionality and doping. Surprisingly, in the trilayer case, a strong electron-hole doping asymmetry has been observed in the SC-phase absent in the bulk. Using DFT+DMFT, we show this doping asymmetry results from a substantial charge reshuffling from the top layer to the middle layer. While the nominal filling per fullerene is close to n = 3, the top layer rapidly switches to an n = 2 insulating state upon hole doping, which implies a doping asymmetry of the SC gap. The interlayer charge transfer and layer-selective metal-insulator transition result from the interplay between crystal field splittings, strong Coulomb interactions, and an effectively negative Hund coupling.</p>
18:00	145	<p style="text-align: center;"><b>Metal-to-insulator transition in SCO thin film upon application of epitaxial strain</b></p> <p style="text-align: center;"><i>Simon Jöhr<sup>1</sup>, Marta Gibert<sup>2</sup>, Jonathan Spring<sup>1</sup>, Alberto Carta<sup>3</sup>, Claude Ederer<sup>3</sup>, Cinthia Piamonteze<sup>4</sup>, Anna Zakharova<sup>4</sup></i></p> <p style="text-align: center;"><sup>1</sup> University of Zürich, <sup>2</sup> Technische Universität Wien, <sup>3</sup> ETH Zürich, <sup>4</sup> Paul Scherrer Institute Villigen</p> <p>Among first row transition metal oxides, the perovskite oxide SrCrO<sub>3</sub> (SCO) remain only vaguely explored. Its properties are still controversial and under debate. Interestingly, this compound has been observed to be metallic and antiferromagnetic at the same time. The goal of this study is to uncover the electric behaviour of SCO thin films as function of strain. Temperature-dependent transport measurements of SCO films grown by RF magnetron sputtering show a strain-driven metal-to insulator transition under application of strain. Recent results of DFT calculations show that tensile strain is responsible for lifting the degeneracy of the t<sub>2g</sub> orbitals and promoting orbital ordering, resulting in the opening of an energy gap.</p>

18:15	146	<p style="text-align: center;"><b>Using uniaxial stress to probe the relationship between competing superconducting states in a cuprate with spin-stripe order</b></p> <p style="text-align: center;"><i>Zurab Guguchia<sup>1</sup>, Debarchan Das<sup>1</sup>, Chennan Wang<sup>1</sup>, Tadashi Adachi<sup>2</sup>, N. Kitajima<sup>3</sup>, Mathias Elender<sup>1</sup>, Felix Brückner<sup>4</sup>, Shreenanda Ghosh<sup>4</sup>, Vadim Grinenko<sup>4</sup>, Toni Shiroka<sup>1</sup>, Markus Müller<sup>5</sup>, Christopher Mudry<sup>5</sup>, Christopher Baines<sup>1</sup>, Marek Bartkowiak<sup>6</sup>, Yoji Koike<sup>3</sup>, Alex Amato<sup>1</sup>, John M. Tranquada<sup>7</sup>, Hans-Henning Klauss<sup>4</sup>, C. W. Hicks<sup>8</sup>, Hubertus Luetkens<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI  <sup>2</sup> Department of Engineering and Applied Sciences, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo 102-8554, Japan  <sup>3</sup> Department of Applied Physics, Tohoku University, 6-6-05 Aoba, Aramaki, Aoba-ku, Sendai 980-8579, Japan  <sup>4</sup> Institute for Solid State and Materials Physics, Technische Universität Dresden, DE-01069 Dresden  <sup>5</sup> Condensed Matter Theory Group, Paul Scherrer Institute, CH-5232 Villigen PSI  <sup>6</sup> Laboratory for Scientific Developments and Novel Materials, Paul Scherrer Institut, CH-5232 Villigen PSI  <sup>7</sup> Condensed Matter Physics and Materials Science Division, Brookhaven National Laboratory, Upton, NY 11973, USA  <sup>8</sup> Max Planck Institute for Chemical Physics of Solids, DE-01187 Dresden</p> <p>I will present muon spin rotation and magnetic susceptibility experiments on in-plane stress effects on the static spin-stripe order and superconductivity in the cuprate system <math>\text{La}_{2-x}\text{Ba}_x\text{CuO}_4</math> with <math>x = 0.115</math> [1]. An extremely low uniaxial stress of <math>\sim 0.1</math> GPa induces a substantial decrease in the magnetic volume fraction and a dramatic rise in the onset of 3D superconductivity, from 10 to 32 K; however, the onset of at-least-2D superconductivity is much less sensitive to stress. These results show not only that large-volume-fraction spin-stripe order is anti-correlated with 3D superconducting coherence, but also that these states are energetically very finely balanced, imposing an important constraint on theoretical models.</p> <p>[1] Guguchia et.al., Phys. Rev. Lett. 125, 097005 (2020).</p>
18:30	147	<p style="text-align: center;"><b>Thermal Ising transition in the spin-1/2 <math>J_1</math>-<math>J_2</math> Heisenberg model</b></p> <p style="text-align: center;"><i>Olivier Clement Romain Gauthé, Frédéric Mila, EPFL</i></p> <p>We use finite-temperature tensor network algorithms to investigate the spin-1/2 <math>J_1</math>-<math>J_2</math> Heisenberg model on the square lattice. We provide strong numerical evidence in favor of an Ising transition in the collinear phase of the model, confirming a 30 years old field theory prediction. In units of <math>J_2</math>, the critical temperature reaches a maximal value of <math>T_c/J_2 \simeq 0.18</math> around <math>J_2/J_1 \simeq 1.0</math>. It is strongly suppressed upon approaching the zero-temperature boundary of the collinear phase <math>J_2/J_1 \simeq 0.6</math>, and it vanishes as <math>1/\log(J_2/J_1)</math> in the large <math>J_2/J_1</math> limit. We stress the importance of symmetry implementation and discuss the new perspectives in the investigation of the thermal properties of quantum Heisenberg antiferromagnets.</p>
18:45	<b>END</b>	

ID	<b>KOND POSTER</b>	
161	<p style="text-align: center;"><b>Far Infrared ellipsometry response of <math>\text{TbMnO}_3</math> thin films</b></p> <p style="text-align: center;"><i>Laurent Bugnon<sup>1</sup>, Christian Bernhard<sup>1</sup>, Premysl Marsik<sup>1</sup>, Christof Schneider<sup>2</sup></i></p> <p style="text-align: center;"><sup>1</sup> Université de Fribourg, <sup>2</sup> Paul Scherrer Institut</p> <p>We use far-infrared ellipsometry to determine the anisotropic optical response of the <math>\text{TbMnO}_3</math> film in the spectral range of 100 - 700 <math>\text{cm}^{-1}</math> and temperature range of 10 - 300 K. The 44 nm thick sample was grown by Pulsed Laser Deposition on an orthorhombic <math>\text{YAlO}_3</math> (010) substrate. We were able to extract phonons properties, and observe softening due to the multiferroic phase transition. The analysis of the <math>\text{TbMnO}_3</math> thin film is complicated by the anisotropic response of the <math>\text{YAlO}_3</math> substrate, which we have precisely determined a priori on a series of <math>\text{YAlO}_3</math> crystals with various surface cuts.</p>	

162	<p style="text-align: center;"><b>Terahertz and infrared magneto-ellipsometer</b></p> <p style="text-align: center;"><i>Premysl Marsik<sup>1</sup>, Laurent Bugnon<sup>1</sup>, Andrei Sirenko<sup>2</sup>, Christian Bernhard<sup>1</sup></i>  <sup>1</sup> <i>Université de Fribourg</i>  <sup>2</sup> <i>Department of Physics, New Jersey Institute of Technology, Newark, New Jersey 07102, USA</i></p> <p>We will present a new magneto-ellipsometric instrument built at the Physics Department, University of Fribourg. It is based on combination of time-domain terahertz and Fourier-transform infrared spectrometers, equipped with He-flow cryostat and split-coil 7 Tesla magnet.</p> <p>Apart from standard transmission geometry, the instrument is designed for reflection ellipsometry measurements at angles of incidence 75° and 80°, with field parallel or perpendicular to the sample surface. The operation can be switched between the THz and IR branch in-situ, and both beam paths are in vacuum. With this instrument, we aim at studies of magneto-optical response of strain engineered thin/ultrathin films of strongly correlated oxides.</p>
163	<p style="text-align: center;"><b>Electronic Properties of SIO - YBCO Thin Film Heterostructures</b></p> <p style="text-align: center;"><i>Jonas Knobel, Mathias Soulier, Subhrangsu Sarkar, Roxana Gaina, Christian Bernhard</i>  <i>University of Fribourg</i></p> <p>We report the pulsed laser deposition (PLD) of multilayers of the cuprate high-<math>T_C</math> superconductor <math>YBa_2Cu_3O_{7-x}</math> (YBCO) and the iridate <math>Sr_2IrO_4</math> (SIO) which exhibits a strong spin-orbit-coupling (SOC). The magneto-transport characteristics of the heterostructures are investigated. They reveal a strong and comparatively long-ranged proximity effect. This gives rise to a suppression of the superconducting response of the YBCO layers up to a thickness of about 14 nm. Moreover, we find a strong and unusual magnetic field dependence. These results point towards a complex interplay between the strong SOC in SIO and superconductivity in YBCO and call for further studies of the microscopic electronic and magnetic properties of these layers.</p>
164	<p style="text-align: center;"><b>Development of a resonant ultrasound setup to explore quantum materials</b></p> <p style="text-align: center;"><i>Xuan Dang Dang, Marek Bartkowiak, Marc Janoschek, Paul Scherrer Institut</i></p> <p>Resonant ultrasound (RUS) probes the resonant frequencies of a solid to determine the complete elastic tensor. RUS is sensitive to detect both the symmetry variation and coupling of other degrees of freedoms to the lattice. Notably, novel electronic ground states may be detected due to their symmetry breaking order parameters resulting in a change of resonant frequencies. Similarly, the coupling of the lattice to spin or charge degrees of freedom may be uncovered by changes in the sound wave attenuation or velocity. Here we will present our development of a resonant ultrasound setup for measurements at low temperature and at magnetic fields optimized to study of quantum matter.</p>
165	<p style="text-align: center;"><b>Uniaxial strain NMR probe</b></p> <p style="text-align: center;"><i>Jonas Philippe<sup>1</sup>, Gediminas Simutis<sup>1</sup>, Marek Bartkowiak<sup>1</sup>, Yasmine Sassa<sup>2</sup>, Sergio Calvo<sup>3</sup>,  Marvin Metzelaars<sup>4</sup>, Paul Kögerler<sup>4</sup>, Marc Janoschek<sup>1</sup></i>  <sup>1</sup> <i>Paul Scherrer Institut</i>, <sup>2</sup> <i>Chalmers University of Technology</i>, <sup>3</sup> <i>Jülich</i>, <sup>4</sup> <i>Aachen</i></p> <p>In quantum magnets, simple degrees of freedom with short-range interactions lead to a plethora of emergent many-body phases with different exotic properties. Uniaxial pressure allows tuning these interactions selectively and engineer the underlying Hamiltonians. Hence, the properties of the emergent phases can be controlled on-demand.</p> <p>One system where such selective tuning is very pertinent is a quantum spin ladder, where only two exchange constants are relevant. In this contribution, we will present our developments of integrating a uniaxial strain device into a Nuclear Magnetic Resonance (NMR) apparatus as well as preliminary measurements on a model ladder system.</p>
166	<p style="text-align: center;"><b>Infrared Ellipsometry study of K-doped pterphenyl bulk</b></p> <p style="text-align: center;"><i>Qi He<sup>1</sup>, Premysl Marsik<sup>1</sup>, Nicola Corrado<sup>2</sup>, Albert Guijarro<sup>3</sup>, Christian Bernhard<sup>1</sup></i>  <sup>1</sup> <i>University of Fribourg</i>, <sup>2</sup> <i>University of Camerino</i>, <sup>3</sup> <i>Universidad de Alicante</i></p> <p>For the doped samples with a nominal compositions of K3-p-terphenyl, we observed a pronounced enhancement of some low-energy phonon modes that is in fair agreement with the prediction of lattice dynamical calculations. Moreover, we observed electronic excitations that give rise to a pronounced polaronic band</p>

	<p>and a weak Drude-like peak at the origin that is due to free carries with a plasma frequency. No anomalous changes of the Drude-response have been observed in the low temperature regime that could be taken as evidence of a bulk-like superconducting transition. An inhomogeneous SC state with a very small volume fraction cannot be excluded based on our optical data.</p>
167	<p style="text-align: center;"><b>SPM functionalization for magnetic sensing</b></p> <p style="text-align: center;"><del>Nico Schikik, Binyang Liu, Johannes Schwenk, Berk Zengin, Fabian Natterer, University of Zürich</del></p> <p><del>Scanning probe microscopy (SPM) techniques are non-invasively used to access information about the material on the level of individual atoms and molecules. Recent advances in quantum-based technology motivate their further evolution overcoming their present limitations. In our work, we explore the possibility to enhance the SPM sensitivity to magnetic fields by decorating the probe apex with an organic molecule. The functionality of this approach is demonstrated by probing the magnetic fields of Abrikosov vortices of type-II superconductors and other prototypical magnetic systems such as single atoms and nano-islands.</del></p> <p><i>cancelled</i></p>
168	<p style="text-align: center;"><b>Distinct electronic structure of novel intercalated series 2H-V<sub>x</sub>TaS<sub>2</sub></b></p> <p style="text-align: center;"><i>Wojciech Radoslaw Pudelko<sup>1</sup>, Huanlong Liu<sup>2</sup>, Karin von Arx<sup>2</sup>, Qisi Wang<sup>2</sup>, Julia Küspert<sup>2</sup>, Ron Cohn Wagner<sup>2</sup>, Hang Li<sup>1</sup>, Eduardo Bonini Guedes<sup>1</sup>, Andreas Schilling<sup>2</sup>, Johan Chang<sup>2</sup>, Nicholas Clark Plumb<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> Paul Scherrer Institut, <sup>2</sup> Physik-Institut, Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich</p> <p>Layered transition metal dichalcogenides are an example of the van der Waals (vdW) materials, hosting many interesting states of matter like charge density wave ordering and superconductivity. In many vdW systems, the material properties can be profoundly and surprisingly sensitive to seemingly minor changes in composition or structure. Currently we are investigating vanadium intercalated V<sub>x</sub>TaS<sub>2</sub>. Despite the very dilute concentration of vanadium (x ≤ 0.05), our preliminary results show significant changes in the Fermi surface topology and band composition compared to the parent 2H-TaS<sub>2</sub>. The discovered spectral features indicate the substantial influence of new c-axis ordering and inter-layer interactions on the electronic properties of the system.</p>
169	<p style="text-align: center;"><b>Microspectroscopy of Magnetic Nanostructures with Soft X-Ray Ptychography</b></p> <p style="text-align: center;"><i>Tim A. Butcher, Simone Finizio, Lars Heller, Manuel Langer, Mirko Holler, Carlos A. F. Vaz, Armin Kleibert, Jörg Raabe, Paul Scherrer Institut</i></p> <p>A technique to unlock spatial resolutions in the order of 10 nm is soft x-ray ptychography. Ptychography consists of moving the sample through a beam of monochromatic x-rays, all the while collecting diffraction patterns from the overlapping illumination spots. Recovery of the complex transmission function is achieved with a reconstruction algorithm. Measurements in the soft x-ray regime benefit from strong x-ray magnetic circular dichroism (XMCD) and x-ray magnetic linear dichroism (XMLD) contrasts. These serve to analyse ferromagnetic and antiferromagnetic materials, respectively. We present the development of the new soft x-ray ptychography endstation at the Swiss Light Source. First results include the imaging of the spin cycloid in multiferroic bismuth ferrite.</p>
170	<p style="text-align: center;"><b>Noise mitigation in silicon quantum devices</b></p> <p style="text-align: center;"><i>Leonardo Massai<sup>1</sup>, Nico Hendrickx<sup>1</sup>, Nicolò Crescini<sup>2</sup>, Eoin Gerard Kelly<sup>1</sup>, Matthias Mergenthaler<sup>1</sup>, Gian von Salis<sup>1</sup>, Andreas Fuhrer<sup>1</sup></i></p> <p style="text-align: center;"><sup>1</sup> IBM Research, <sup>2</sup> Institut Neel - CNRS</p> <p>Superconducting circuits and spins confined in semiconductor structures represent two leading qubit implementations. Continuous fabrication improvements and a better understanding of semiconductor-oxide interfaces are crucial to enhancing qubit performance. We use noise spectroscopy in silicon quantum dots to evaluate the substrates and oxides. Furthermore, we present a novel design for superconducting resonators, aiming to improve their internal quality factor by modifying the conductor geometry and minimizing the presence of oxides at the relevant interfaces. We study the reproducibility of the fabrication and explore the properties of different superconducting materials. Addressing these sources of noise and reducing their impact on qubits will be critical for future development of scalable quantum-computing platforms.</p>

171	<p style="text-align: center;"><b>Adsorption of Argon on Graphite</b></p> <p style="text-align: center;"><i>Rémi Marcel Léon Claude, Paolo Usai, Siham Benhabib, Fabrizio Carbone, EPFL</i></p> <p>By means of the ultrafast electronic diffraction (UED) in reflection geometry, we observe argon atoms adsorbed on graphite with atomic resolution. The diffraction patterns of solid argon adsorbed on graphite compared with simulation shows FCC structure in (111) orientation. Interesting physical phenomena emerge from the experiment as the phase diagram dependence on substrate surface; the compression of the lattice during lattice growth and warm up; the ordering of lattice surface before sublimation point during warm up. This experiment drives us to study the fundamental science of 2D materials.</p>
172	<p style="text-align: center;"><b>Spatial modulations of the density of states due to atomic defects in bulk ZrSe<sub>2</sub></b></p> <p style="text-align: center;"><i>Andreas Ørsted, Alessandro Scarfato, Enrico Giannini, Christoph Renner, University of Geneva</i></p> <p>ZrSe<sub>2</sub> in its pristine bulk form is an insulator and does not support a CDW phase. However, a recent study of mono- and few-layer ZrSe<sub>2</sub> on graphene reports the observation of a 2x2 CDW driven by charge transfer from the substrate.[1]</p> <p>We use cryogenic STM and STS to study in-situ cleaved bulk ZrSe<sub>2</sub> and present a spatial spectroscopic investigation of native defects and their influence on the electronic structure of ZrSe<sub>2</sub>. Our study finds spatial modulations in the LDOS consistent with the previously reported results, suggesting that a similar CDW phase in bulk ZrSe<sub>2</sub> may be driven by native atomic defects.</p> <p>[1] Ren et al., Nano Letters 22 476-484 (2022)</p>
173	<p style="text-align: center;"><b>Schottky contacts for silicon spin qubits</b></p> <p style="text-align: center;"><i>Lisa Sommer, Konstantinos Tsoukalas, Matthias Mergenthaler, Siegfried Karg, Andreas Kuhlmann, Felix Julian Schupp, Gian von Salis, Patrick Harvey-Collard, Andreas Fuhrer, IBM Research</i></p> <p>Silicon FinFETs are used in classical CMOS electronics but can also provide an attractive platform for the implementation of spin qubits. Classical transistors usually have highly doped contacts that determine device polarity (n-type or p-type). Our FinFET quantum dots have Schottky contacts formed by a silicide. These contacts can be ambipolar for a midgap silicide such as e.g. NiSi. For a low contact resistance to holes, PtSi is more suitable because it has a lower Schottky barrier height. Here, we study the behavior of these Schottky contacts at cryogenic temperatures and with intrinsic silicon substrates and also investigate ErSi as a potential low resistance n-type Schottky contact material.</p>
174	<p style="text-align: center;"><b>Density of state oscillations in InAs/AlSb/GaSb bilayer systems</b></p> <p style="text-align: center;"><i>Amina Solano Lopes Ribeiro, R. Schott, Christian Reichl, W. Dietsche, Werner Wegscheider Department of Physics, ETH Zürich</i></p> <p>Exotic states of matter are predicted to be found in 2D bilayer systems such as InAs/GaSb heterostructures. These are usually described as two adjacent quantum wells of InAs and GaSb where the conduction band of the former lies below the valence band of the latter. We present a variation of this structure using an insulating AlSb barrier between InAs and GaSb layers, acting as an n and a p layer, respectively. We highlight the observation of a two-dimensional electron gas (2DEG) and a two-dimensional hole gas (2DHG) created in the vicinity of the insulating AlSb barrier. Using capacitance techniques, we succeed to measure the accumulation of charge carriers close to the barrier already in equilibrium regime, i.e., without any applied DC voltages. By applying positive DC bias, we modify the density of the 2D charge gas as can be seen via the Shubnikov-deHaas (SdH) oscillations. This scenario is motivating for deeper understanding about how excitons are generated and behave in an Excitonic condensate or Bose-Einstein condensate (BCS) regime. Further interaction effects that are created from this observation will be discussed.</p>