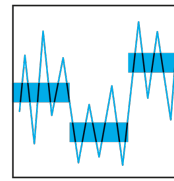
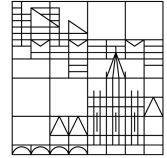


# Physikalisches Kolloquium

SFB 1432



Universität  
Konstanz



Di 08.02.22  
15:15 Uhr  
Zoom:

<https://zoom.us/j/96749765846?pwd=T0FKUGVZN29saTNVZT Z2dzRzRm1nQT09>



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University of Trieste and  
Elettra - Sincrotrone Trieste S.c.p.a.

## Quantum spectroscopies for quantum materials

The rich phase diagrams of many transition metal oxides (TMOs) is the result of the intricate interplay between electrons, phonons, and magnons. This makes TMOs very susceptible to external parameters such as pressure, doping, magnetic field, and temperature which in turn can be used to finely tune their properties. The same susceptibility makes TMOs the ideal playground to design experiments where the interaction between tailored electromagnetic fields and matter can trigger the formation of new, sometimes exotic, physical properties. This aspect has been explored in time domain studies [1] and has led to the demonstration that ultrashort mid-IR light pulses can “force” the formation of quantum coherent states in matter, disclosing a new regime of physics where thermodynamic limits may be bridged and quantum effects can, in principle, appear at ambient temperatures.

In this presentation, I will review our recent results in archetypal strongly correlated cuprate superconductors and demonstrate the feasibility of a light-based control of quantum phases in real materials [2,3,4]. I will then introduce our new approaches to time domain spectroscopy going beyond mean photon number observables [5-10] and show that the statistical features of light can provide richer information than standard linear and non-linear optical spectroscopies[11]. Finally, I will elaborate on our current directions on leveraging both the electromagnetic field fluctuations and the strong driving of materials to control the onset of quantum coherent states in complex materials.

- [1] Advances in physics 65, 58-238, 2016,
- [2] Science 331, 189-191 (2011)
- [3] Phys. Rev. Lett. 122, 067002 (2019)
- [4] Nature Physics 17, 368–373 (2021)
- [5] Phys. Rev. Lett. 119, 187403 (2017)
- [6] New J. Phys. 16 043004 (2014)
- [7] Nat. Comm. 6, 10249 (2015)
- [8] PNAS March 19, 116 (12) 5383-5386 (2019)
- [9] J. of Physics B 53, 145502 (2019)
- [10] Optics Letters 45, 3498 (2020)
- [11] <https://arxiv.org/abs/2111.14488> (accepted NatureLSA)

