Group of **U**ltra**F**ast **O**ptical **S**pectroscopy
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Institutsseminar IFK

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Title: Hide and seek in the electron's world

Abstract: For many years, since the beginning of the 19th century, the existence of magnetism in low dimensions has been both desired and controversial. It was long thought, that magnetic orders in low dimensional systems could not be realized at temperatures different from zero. At least, this was what the Mermin-Wagner theorem stated for isolated Heisenberg spins. The scarcity of low-dimensional materials with magnetic properties, and the partial understanding of the role of spin-anisotropy have supported this picture for several decades.

In three-dimensions, magnetism has revolutionized our everyday life, enabling familiar technologies which are of common use. A few examples include computers' memories, RAM, hard-disks, key cards, credit cards, electric batteries, light, and distance sensors. This relentless pace of development has motivated the search for magnetism in systems with increasingly smaller sizes.

With cooperation of experimental and theoretical physics, researchers discovered that spin-anisotropy can stabilize low-dimensional magnetism. In this, spin-orbit coupling plays an important role. Surface experimental probes, such as angle-resolved photoelectron spectroscopy provide researchers access to the electronic structure of solids. Despite the advances in the field, recently, new forms of surface local magnetism completely different from standard descriptions have appeared.

Here, I aim to give an overview of a new powerful methodology to uncover hidden phases of electrons, including spins, and magnetism which was so fare elusive. I will do this by showing two of my research achievements.

Short Bio: Federico Mazzola was awarded his PhD in Physics in 2016. After a postdoc at the University of St Andrews and in Trieste he moved to Venice, where he works as researcher at the University Ca Foscari. His area of research focuses on the electronic structure and properties of quantum materials ranging from semiconductors, semimetals, topological insulators to superconductors, with particular interest in the many-body interactions that underpin their physical properties and how these can be tuned using quantum confinement and modifying their crystalline symmetry. His work is motivated by the synthesis and study of novel systems, which could provide a suitable platform for integration with existing semiconductor-based technology.