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EXPLORING THE EVOLUTION OF THE ORBITAL AND MAGNETIC ORDERING IN CA2RUO4 UNDER AN APPLIED FIELD

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Despite researchers developed a very good understanding of metallic and insulating states in condensed matter systems, the situation changes dramatically in the proximity of a metalinsulator (MI) transition [1]. In fact, difficult to model electronic correlations are very often at the origin of such abrupt change that the whole model to describe the system properties and excitations need to be adapted to the different electronic behavior. MI transitions are also peculiar as it is not straightforward to identify a primary order parameter. Recently a lot of interest arose around 4d based materials, where the occupancy of the 4d shell is a critical element in establishing the electronic correlations [2]. Ru based materials are often in a metallic state, however a notable exception is represented by Ca2RuO4 (fig.1), this distorted Ruddlesden Popper system, is in an insulating state at room temperature, however the transport properties can be easily modified increasing the temperature [3] or the pressure [4], or as more recently demonstrated applying an unprecedently low voltage to the system [5]. Resonant X-ray scattering (RXS) offers a unique opportunity to monitor the structural, magnetic and electronic properties of this fascinating material by following the evolution of the diffraction peaks related to the orbital, magnetic and structural properties of the system as function of the temperature and of an applied field. In this talk, after a brief introduction to the RXS technique, we will review the current understanding of the system behavior and present our new insight about the evolution of the electronic properties of the system [6]. The most exciting result being the fully reversible suppression of the orbital ordered before the destructive IM transition is completed.

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