Time-Reversal Symmetry-Breaking in Charge-Ordered Kagome-Lattice Systems Probed with Muon Spin Rotation

Zurab Guguchia

Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland

Kagome lattices stand at the forefront of research due to their fascinating interplay of topology, correlations, and magnetism [1-3]. In my talk, I aim to shed light on the latest experimental developments concerning superconductivity and the magnetic aspects of charge order in various kagome-lattice systems, studied from the perspective of local magnetic probe. This involves the use of muon-spin rotation (μSR) as a function of depth from the crystal surface and under extreme conditions like hydrostatic pressure, uniaxial strain, ultra-low temperatures, and high magnetic fields. μSR is complemented by magnetoresistance and X-ray diffraction techniques. Key systems under discussion will include: (1) The AV_3Sb_5 (A = K, Rb, Cs) compound series with V kagome lattice, notable for displaying a range of symmetry-breaking electronic orders, such as charge order and superconductivity. Here, we have identified a depth-tunable time-reversal symmetry-breaking state associated with charge order [4-7]. (2) The bilayer kagome material ScV_6Sn_6, where hidden magnetism within the charge-ordered state was observed [8]. (3) The $LaRu_3Si_2$ system with Ru kagome layers, in which we identified two distinct types of charge order (bond order), with one manifesting above room temperature [9,10]. This finding marks the first instance of observing a charge-ordered state at room temperature in a kagome lattice.

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