Experimental report

27/02/2019

Proposal: **4-01-1442**

Council: 10/2014

Title: Magnon dispersion in Ca2RuO4: the role of spin orbit coupling

Research area: Physics

This proposal is a new proposal

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Samples: Ca2(RuTi)O4

Instrument	Requested days	Allocated days	From	To
IN8	6	7	28/04/2015	05/05/2015

Abstract:

Layered ruthenates exhibit a large variety of interesting phenomena reaching from unconventional superconductivity in Sr2RuO4 to a Mott-insulating state in Ca2RuO4 and a metamagnetic transition which is associated with quantum-critical behaviour.

The theoretical analysis of the electronic structure of Ca2RuO4 is quite complex due to the fact that there are four electrons per Ru site which occupy the three t2g orbitals in a low-symmetry structure. As the orbital moment is not fully quenched there is sizeable spin-orbit coupling. The most recently published theory tries to bridge the Mott state in Ca2RuO4 with that in iridates (like Sr2IrO4) where spin orbit coupling is the essential interaction to determine the magnetic ground state.

Ca2RuO4 seems to be very well suited for studying the impact of strong spin-orbit coupling on a Mott insulator in close relation to the enormous efforts recently made on iridates. Inelastic neutron scattering studies are required to analyze the magnon dispersion in Ca2RuO4 which is supposed to clarify the magnetic ground state.

Published in:

Highly Anisotropic Magnon Dispersion in Ca_2RuO_4: Evidence for Strong Spin Orbit Coupling

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The magnon dispersion in Ca_2RuO_4 has been determined by inelastic neutron scattering on single crytals containing 1% of Ti. The dispersion is well described by a conventional Heisenberg model suggesting a local moment model with nearest neighbor interaction of $J=8$ meV. Nearest and next-nearest neighbor interaction as well as interlayer coupling parameters are required to properly describe the entire dispersion. Spin-orbit coupling induces a very large anisotropy gap in the magnetic excitations in apparent contrast with a simple planar magnetic model. Orbital ordering breaking tetragonal symmetry, and strong spin-orbit coupling can thus be identified as important factors in this system.