Experimental report

10/09/2022

Proposal: 4-01-1747 **Council:** 4/2021

Title: Inelastic neutron scattering studyof 5d4 chain compound La2ZnRuO6

Research area: Physics

This proposal is a new proposal

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Samples: La2ZnRuO6

Instrument	Requested days	Allocated days	From	To
PANTHER	4	3	23/06/2021	24/06/2021
			06/07/2021	08/07/2021

Abstract:

Recently, a strong interest has arisen from the 4d and 5d transition metals. Indeed, spin-orbit coupling and electronic correlations naturally combine in those materials, which in turn may host new phases of matter. According to recent theoretical work, the d4 electronic configuration is quite interesting as super-exchange opposes to spin-orbit coupling, yielding a phase transition from nonmagnetic atomic singlets to novel and unexplored magnetic phases. An excellent candidate to test this physics is La2ZnRuO6, a double perovskite with ordered B-site where the Ru4+ is in the 4d4 configuration. Owing to our preliminary characterizations, this particular material could be at the border between those phases. We propose an INS study of this candidate material on PANTHER.

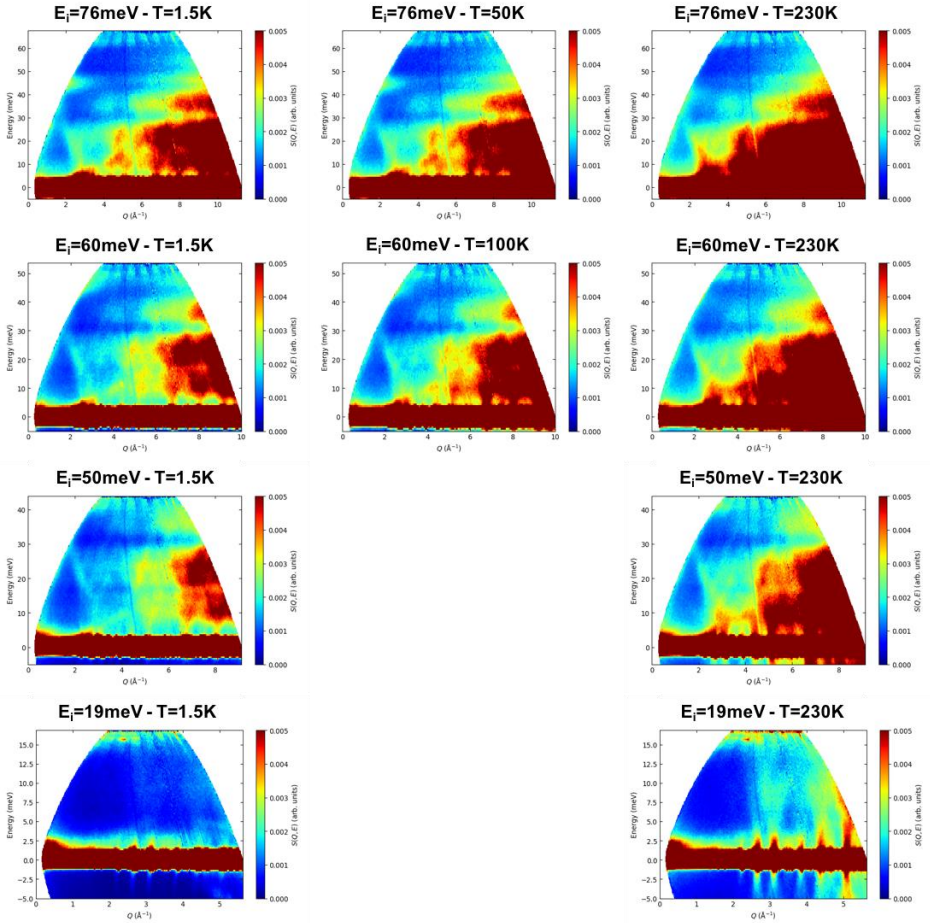
Exp report 4-01-1747: Inelastic neutron scattering measurements in La_2ZnRuO_6.

Context: Inelastic neutron scattering measurements have been performed on Panther (4-01-1747) in order to probe the high-energy magnetic excitations in La_2ZnRuO_6. Other related experiment: D7 (5-32-928).

Experiment: We performed measurements with 3.5 grams of powder sample loaded in a double-wall Al can, for different incident energies at a few temperatures. Using a standard orange cryostat, we collected data for:

- E_i = 76 meV at T=1.5 K, 50 K, and 230 K
- E_i = 60 meV at T=1.5 K, 100 K, and 230 K
- E_i = 50 meV at T=1.5 K and 230 K
- E_i = 19 meV at T=1.5 K and 230 K

The following figure presents a summary of all the $S(Q, E)$ maps. We observe a signal around E = 45 meV at low temperature which decreases and then vanishes at higher temperatures.



To go further, imaginary part of the magnetic susceptibility χ'' can be calculated. One can also perform temperature difference between low and high temperatures.

In the final figure, the χ'' map at 1.5 K has been subtracted by the one at 230 K, for all the incident energies. Our results suggest there is a mode at E = 45 meV only. An analysis based on a careful study of the crystal field and sin orbit physics is ongoing.