Experimental report

14/09/2022

Proposal: **5-32-928**

Council: 4/2021

Title: Magnetic correlations in the d4 chain compound La2ZnRuO6

Research area: Physics

This proposal is a new proposal

Main proposer: **Virginie SIMONET**

Experimental team: Lucile MANGIN-THRO
Sylvain PETIT
Virginie SIMONET
Beatrice GRENIER
Elsa LHOTEL

Local contacts: Lucile MANGIN-THRO

Samples: La2ZnRuO6

Instrument	Requested days	Allocated days	From	To
D7	8	5	08/09/2021	13/09/2021

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 to measure magnetic correlations at D7 in this candidate material.

Exp report 5-32-929: Short-range correlations in La_2ZnRuO_6

Context

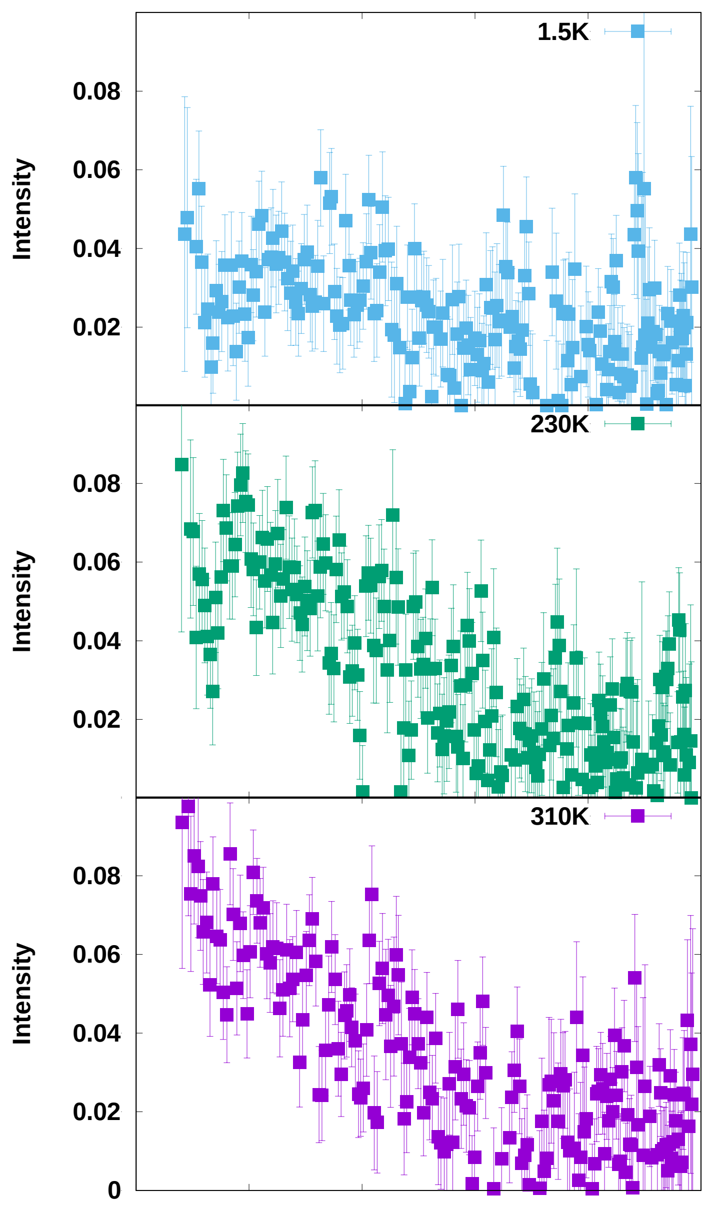
Diffuse neutron scattering measurements have been performed on D7 (5-32-928) to look for magnetic short-range correlations in La_2ZnRuO_6.

Other related experiment: Panther (4-01-1747).

Experiment

We performed measurements with 3.5 grams of powder sample loaded in a double-wall Al can at the wavelength λ = 4.8 Å, for three different temperatures: 1.5 K, 230 K, and 310 K, using a standard orange cryostat. D7 being equipped with permanent polarization analysis, we were able to separate the magnetic, nuclear, and incoherent contributions. To do so, we collected data in the polarization configurations (X, Y, Z)/(SF, NSF), and the usual calibration measurements (vanadium, quartz, and backgrounds) have been realised.

The following figures present the magnetic scattering at T = 1.5 K (top), T = 230 K (middle), and T = 310 K (bottom).



Our data at low temperature suggest there is a large bump-like magnetic signal around $Q \sim 0.5 - 1$ Å^{-1} which gradually disappears towards a paramagnetic-like shape when increasing temperature.

Please note that no background correction was applied to the raw data. Nevertheless, the method to extract the magnetic signal involves a linear combination of the different cross-sections. Assuming the background is the same in all the three orthogonal directions (X, Y, Z), a self-subtraction of the background occurs. This method has the advantage to give better statistics.