Coupling between electronic band structure and magnetic ordering in $NaOsO_3$: insights from magnetization dynamics experiments

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The strong connection between the electronic band structure and magnetic ordering of $NaOsO_3$ has garnered considerable interest recently [1-3]. $NaOsO_3$ undergoes an insulator to metal transition at the unusually high temperature of 411 K and presents also low temperature anomalies in the resistivity that has sparkled interest both on the nature of the phase transition and of the evolution of the band gap with temperature. We have used muon spin rotation spectroscopy and time-resolved x-ray diffraction at free electron laser to get more insight on the role of the magnetic fluctuations and magnetization dynamics in the vicinity of the phase transition. Our x-ray measurements demonstrate that the antiferromagnetic long-range order in question melts within sub-100 fs, significantly faster than the lattice dynamics observed in the intensity of selected Bragg structural reflections, which decrease over several ps [4]. Furthermore, we conducted muon spin relaxation measurements around T_A = 30 K, as this temperature range was implicated in the emergence of an anomaly in the electrical resistivity, potentially linked to a gradual decrease in the Os magnetic moment caused by spin fluctuations [2]. Our findings indicate that there is no significant alteration in the frequency of spin fluctuations at T_A, as observed within muon probing time scale [5].

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