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Phase diagram of the perovskite solid solution $CaCu_3Ti_{(4-x)}Ru_xO_{12}$ elucidated with bulk μ^+SR

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The $CaCu_3Ti_{(4-x)}Ru_{(x)}O_{12}$ family, synthesized under high pressure (7.7 GPa) belongs to the perovskite class of materials. The ground state of the extremes of this solid solution are antiferromagnetic insulator for the x = 0 member, and itinerant-electron system, i.e., Pauli-paramagnetic metal, for the x = 4 member respectively **[1,2]**. The suppression of magnetic ordering from the x = 0 to the x = 4 member of the solid solution seems to be accompanied by non-Fermi liquid (NFL) behavior since $CaCu_3Ti_4O_{12}$ manifested indications of such a behavior in heat capacity measurements **[3]**. These features make the solid solution $CaCu_3Ti_{(4-x)}Ru_{(x)}O_{12}$ a promising candidate for possessing a Doniach-type phase diagram **[4]**. In this work we present the results of a bulk muon spin rotation study on the intermediate members of the solid solution, showing the evolution of the magnetic ground state going from antiferromagnetic to paramagnetic. Evidence of highly dynamical ground states are also found among the members of the solid solution and a tentative phase diagram as a function of the Ru content x is proposed.

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Primary author: NOCERINO, Elisabetta (KTH Royal Institute of Technology)

Co-authors: Dr FORSLUND, Ola K. (Chalmers); ELSON, Frank (KTH, Royal Institute of Technology); Dr PALM, Rasmus (KTH Royal Institute of Technology); Ms MINIOTAITE, Ugne (KTH Royal Institute of Technology, Sweden); Dr SAKURAI, Hiroya (NIMS); Mr PAPADOPULOS, Konstantinos (Chalmers University of Technology); Prof. SASSA, Yasmine (Chalmers University of Technology); SUGIYAMA, Jun (CROSS Neutron Science and Technology Center); Prof. MANSSON, Martin (KTH Royal Institute of Technology)

Presenter: NOCERINO, Elisabetta (KTH Royal Institute of Technology)

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