SEMINAIRE DE LA MATIERE CONDENSEE

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Function from Frustration in modern multiferroics

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Salle de conférence 15 – Bâtiment 563

Although in conventional ferroelectrics the requirements of magnetism and ferroelectricity are chemically incompatible[1], recent investigations of spin frustrated manganite perovskites $RMnO_3$ (where R is a rare earth ion) have shown that this chemical incompatibility can be overcome by frustration[2,3]. In particular spin frustrated perovskite manganites for appropriate size R-ions show a peculiar transverse spiral magnetic ordering that breaks inversion symmetry[4]. The spontaneous polarization of these frustrated magnets is in the order of □0.5μC/cm^2 and smaller than conventional ferroelectrics[3]. What is novel however is that the direction of the polarization can be controlled via magnetic field. The emergence of multiple ferroic properties for these materials has led to their description as *multiferroics*.

In this talk I will discuss the mechanism by which ferroelectricity can be coupled to magnetism in $RMnO_3$ perovskites and describe the changes in the magnetic structure associated with changes in the ferroelectric polarization. The magnetic excitation spectrum that we have recently measured using cold neutron spectroscopy supports evidence that the fundamental driving mechanism behind these multiferroics is the coupling of a magnon to polar phonons, or electromagnon[5]. I will further show how the ordering of the rare earth spins couple to the Mn-spins and in the case of R=Dy can enhance the ferroelectric polarization by as much as a factor of 3[6].

*In collaboration with N. Aliouane, S. Landsgessel, O. Prokhenko, E. Dudzik, Ralf Feyerherm. J. Strempfer and I. Zekinoglou, M. Mostovoy and D. Senff and M.Braden.

[1] N. A. Hill, J.Phys. Chem. B104, 6694(2000).
[2] T. Kimura, *et al.* Phys. Rev. B68, 060403(R)(2003).
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[5] D. Senff *et al.* Phys. Rev. Lett. 98, 137206 (2007)
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[7] O. Prokhnenko *et al.* Phys. Rev. Lett. 99, 177206 (2007)

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