

CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

Mercredi 30 mars 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

**NMR study of the pressure induced Mott transition to
Superconductivity in the newly discovered Cs₃C₆₀ isomeric
compounds**

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The discovery in 1991 of high temperature superconductivity in A₃C₆₀ compounds, where A is an alkali ion, has been rapidly ascribed to a BCS mechanism, in which the SC pairing is mediated by on ball optical phonon modes. While this has lead to consider that electronic correlations were not important in these compounds, further detailed studies of various A_nC₆₀ compounds with n=1, 2, 4 [1-3] allowed to evidence that the electronic properties of these compounds cannot be explained by a simple progressive band filling of the C₆₀ six-fold degenerate t_{1u} molecular level. This could only be ascribed to the influence of electron correlations and Jahn-Teller Distortions (JTD) of the C₆₀ ball, which energetically favour evenly charged C₆₀ molecules [1]. We shall report the recent discovery of two expanded fulleride Cs₃C₆₀ isomeric phases which are Mott insulators at ambient pressure [4-5]. Both phases undergo a pressure induced first order Mott transition to superconductivity with a (p, T) phase diagram displaying a dome shaped superconductivity, a common situation encountered nowadays in correlated electron systems [5]. NMR experiments allowed us to study the magnetic properties of the Mott phases, to evidence the onset of large magnetic fluctuations with decreasing pressure towards the Mott transition, and to follow the phase diagram up to a critical point near room T, analogous to that observed at the liquid-gas transition. So, although superconductivity admittedly results from an electron-phonon mechanism, the incidence of electron correlations has an importance on the electronic properties, as had been anticipated from DMFT calculations [6].

[1] M. Capone, M. Fabrizio, P. Giannozzi and E. Tosatti, Phys. Rev. B 62 ,7619 (2000).

[2] V. Brouet, H. Alloul, T.N Le, S. Garaj and L. Forro, Phys. Rev. Lett. 86, 4680 (2001); V. Brouet, H. Alloul et al, Phys. Rev. B 66, 155122(2002).

[3] V. Brouet, H. Alloul et al Phys. Rev. Lett. 82, 2131 (1999); Phys. Rev. B 66, 155123 (2002).

[4] Y. Takabayashi et al Science 323, 1585 (2009).

[5] Y. Ihara , H. Alloul, P. Wzietek, D. Pontiroli, M. Mazzani and M. Riccò, Phys. Rev. Lett. 104, 256402 (2010) and <http://arxiv.org/abs/1102.5693>, submitted to EPL.

[6] M. Capone, M. Fabrizio, C. Castellani and E. Tosatti, Rev. Modern Physics, 81, 943 (2009).

A coffee break will be served at 11h00. The seminar will be given in English.

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