ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

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3rd Floor Seminar Room

"Emergence of unconventional antiferromagnetism in frustrated magnetic systems"

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ABSTRACT

In the last years the role of antisymmetric Dzyaloshinskii-Moriya (DM)interactions in antiferromagnetic Heisenberg spin systems has beenintensively investigated in a number of emergent materials withremarkable electronic and magnetic properties, as for example LaMnO3,the parent compound of manganites, and multiferroic materials. Alsobelonging to the class of DM antiferromagnets is La2CuO4. In this case the interest on the magnetism is twofold: indeed, besides theoccurrence of (unconventional) antiferromagnetism in the pure compound, when the system is doped with holes the antiferromagnetic phase rapidly disappears and the system becomes a high-temperature superconductor. While a general consensus exists on the microscopic mechanisms relevant in the antiferromagnetic phase, the interplay between charge and spin degrees of freedom in doped compounds is still strongly debated. In this talk I will review our theoretical progress in understanding the role DM interactions have on the physics of undoped and lightly-doped La-based cuprates. Using a powerful and elegant field-theory approach based on the non-linear sigma model, we developed a consistent description of the magnetic phase, and we showed the emergence of interesting experimental issues, as for example the occurrence of new selection rules in Raman spectroscopy. Starting from this "magnetic" point of view we analyzed also how magnetic properties of La2CuO4 are affected by frustration upon doping. Our approach accounts very well for magnetoresistance measurements in lightly-doped compounds, suggesting that at least at these low-doping level charge degrees of freedom are strongly influenced by the underlying magnetism.