Session: Highly Correlated Systems

Abstract

The discovery of high-temperature superconductivity in doped copper oxides opened many new questions and gave rise to a large number of studies of strongly correlated systems. Band theory [1], which was considered some sort of standard model of condensed matter physics, failed in describing these materials characterized with open *d* and *f* shell. As a matter of fact, the energy scale coming from the interaction between the electrons from the outer *d* (*f*) shell becomes of the same order as the band energy gain. These electrons are localized hence their behavior cannot be described by conventional band theory. The presence of the strong correlations between the electrons can lead to a large variety of possible novel quantum phases and many interesting unusual phenomena, such as metal-insulator transition [2], topological ordering [3], spin liquids [4], and among all the very popular and highly debated superconductivity phenomena [5]. In order to explain the mechanism behind these materials, many new theoretical methods have been developed, such as DMFT [6], slave approaches [7], diagrammatic Monte Carlo Methods [8], etc.

Invited Speaker

Aldo Isidori, Scuola Internazionale Superiore di Studi Avanzati di Trieste (Italy)

References

[1] N. W. Aschcroft and N. D. Mermin**,** *Solid State Physics*, Saunders (1976)
[2] M. Imada, A. Fujimori and Y. Tokura, *Rev. Mod. Phys.* **70**, 1039 (1998)
[3] D. J. Thouless, M. Kohmoto, M. P. Nightingale and M. den Nijs, *Phys. Rev. Lett.* **49**, 405 (1982)
[4] L. Balents, *Nature* **464**, 199 (2010)
[5] P. W. Anderson, *The theory of superconductivity in the high-Tc cuprate superconductors* **446**, Princeton University Press, Princeton (1997)
[6] A. Georges, G. Kotliar, W. Krauth and M. J. Rozenberg, *Rev. Mod. Phys.* **68**, 13 (1996)
[7] G. Kotliar and A. E. Ruckenstein, *Phys. Rev. Lett.* **57**, 1362 (1986)
[8] G. Kotliar, S. Y. Savrasov, K. Haule, V. S. Oudovenko, O. Parcollet and C. A. Marianetti, *Rev. Mod. Phys.* **78**, 865 (2006)