



ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUMThursday, 12 February 2009
17:00-18:003rd Floor Seminar Room***“Optics clues to pairing glues”***Dirk van der Marel
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Abstract

According to the standard model of superconductivity, electrons form pairs due to a retarded attractive interaction mediated by virtual collective excitations of the solid. These collective excitations constitute the ‘glue’ which binds the electrons together, similar to the way in which forces are transmitted between elementary particles. In a solid the bosons transmitting the interaction are fluctuations of the nuclear coordinates, spin-polarization, electric charge or current.

Ever since the discovery of high temperature superconductivity the issue whether or not the pairing is either mediated by a bosonic ‘glue’ or by a radically different mechanism, and the nature of a ‘glue’ -if it exists- have been subject of intensive theoretical and experimental investigation [1,2,3]. If the ‘glue picture’ is applicable, infrared optical spectroscopy can be used to measure the proliferation of these bosons for certain energy and its coupling to electrons.

In recent years we have taken advantage of the connection between the free carrier optical conductivity and the glue function to reconstruct the glue-spectrum of a large range of high- T_c materials from the experimental optical spectra. In all cases a characteristic peak is found in the 50-60 meV range, which could be a phonon, as well as a continuum extending to 0.3 eV which is most likely electronic in nature. These two components of the function provide important quantitative clues regarding the intriguing question why T_c is so exceptionally high in these materials [4].

[1] H. J. A. Molegraaf *et al.*, *Science* **295**, 2239-2241 (2002).

[2] Bickers *et al.*, *Phys. Rev. B* **42**, 67 (1990)

[3] P.W. Anderson, *Science* **317**, 1705 (2007)

[4] E. van Heumen *et al.*, [arXiv:0807.1730](https://arxiv.org/abs/0807.1730)