SFB/TRR 21 - Colloquium

21. Oktober 2011, Stuttgart

Vladimir Krasnov
(Stockholm University)

How to determine the coupling mechanism of high temperature superconductors?

For a quarter of a century high temperature superconductivity (HTSC) in cuprates remains one of the most acute unresolved problems of modern physics. The most important task is to establish the coupling mechanism in cuprates. In low Tc superconductors the pairing is mediated by phonons, but for cuprates the binding "glue" for electrons is not yet confidently known. It is widely believed that spin waves (antiferromagnetic magnons) are playing the central role, however, other bosons, like phonons or plasmons can not be safely discarded. To achieve a breakthrough in understanding HTSC, direct and unambiguous probe for bosonic coupling mechanism is needed. Here I will describe a novel "non-equilibrium" spectroscopy, which has an ability to directly and unambiguously disclose the pairing mechanism of HTSC. The main idea is very simple: non-equilibrium quasiparticles, injected in a superconductor, must relax to the ground state eventually recombining into Cooper pairs. This inelastic process is accompanied by emission of radiation. Importantly, bosons which are mediating superconductivity are emitted upon recombination of two quasiparticles. For example, phonons are emitted by low-Tc superconductors, which was beautifully demonstrated by phonon generation-detection experiments in 70th. This brings me to the main point. Non-equilibrium radiation consists of excitations that mediate superconductivity. Therefore, to determine the coupling mechanism of HTSC one needs to detect and identify the content of recombination radiation: whether it consists of phonons, spin waves or something else. I will describe several experimental efforts to generate and detect both equilibrium and non-equilibrium radiation using the intrinsic Josephson effect in layered cuprates.

21. Oktober 2011, 14:00 Uhr

Universität Stuttgart, NWZII, Raum 2.136
Pfaffenwaldring 57, 70569 Stuttgart

CO.CO.MAT