T_cSAM Bi-Weekly Brown Bag Seminar

Texas Center for Superconductivity and Advanced Materials

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"Collective Modes in Unconventional Superconductors"

Friday, September 24, 2004

Room 102, University of Houston Science Center
12:00 noon – 1:00 p.m.

Abstract

After the recent discovery of collective modes in unconventional superconductors (USC), their study becomes very important.

Collective modes (CM) in HTSC exhibit themselves in many experiments: ultrasound attenuation (UA) and microwave absorption (MWA), neutron scattering, photoemission and Raman scattering, etc. The large peak in the dynamical spin susceptibility in HTSC arises from a weakly damped spin-density-wave CM. This gives rise to a dip between the sharp low energy peak and the higher binding energy hump in the ARPES spectrum. Also, the CM of amplitude fluctuation of the *d*-wave gap yields a broad peak above the pair-breaking threshold in the B_{lg} Raman spectrum. The contribution of collective modes to UA and MWA may be substantial.

We consider two-dimensional and three-dimensional models of *p*- and *d*-pairing for superconductors built by the path integration technique. Within these models we calculate the collective excitations in different unconventional superconductors [high temperature superconductors (HTSC), heavy fermion superconductors (HFSC), etc.] under *p*- and *d*-pairing. We consider both bulk and 2D systems. Some recent ideas concerning realization in HTSC of the mixtures of different states are investigated. In particular, we consider the mixture of two *d*-wave states in HTSC (of $d_{x^2-y^2}$ and d_{xy} states). Obtained results could be used for interpretation of the sound attenuation and microwave absorption data as well as for identification of the type of pairing and order parameter in unconventional superconductors. They allow us to distinguish pure d-wave state from the mixture of two *d*-wave states in HTSC.

Professor Peter Brusov, T_CSAM Visiting Professor for Fall 2004, graduated in 1972 from Rostov-on-Don State University, and received his Ph.D. degree in 1980 from Leningrad Polytechnical Institute (V. N. Popov, advisor). He received the Doctor of Physical and Mathematical Sciences degree, Professor in 1987 from Moscow/Dubna JINR. He was Senior Scientist, Physical Research Institute, Rostov-on-Don State University from 1980 to 1988, and was Visiting Scientist, Helsinki University of Technology, from 1983 to 1984. Since 1988 he has served as Head of the Low Temperature Laboratory, Physical Research Institute, and Professor at Rostov-on-Don State University. Professor Brusov has been a Visiting Professor at Northwestern University (1989-1990; 1995), Cornell University (2000-2001), and Osaka City University (2004). He has over 90 publications and three books, including *The Mechanisms of HTSC*, RSU Publishing, v. 1-2, 1389 p, 1999; *The Collective Excitations in Superfluid Quantum Liquids*, RSU Publishing, 200 p, 1984; and *The Superfluidity and Collective Properties of Quantum Liquids*, Moscow, Nauka, 216 p, 1988. His research interests are collective properties of unconventional superconductors (USC), symmetry of order parameter of USC, collective modes in *d*-wave and *p*-wave superconductors, and ultrasound attenuation and microwave absorption in USC.

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