

Poster Presentation

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Superconductivity Mechanism in the Modulated Quantum Well of YBCO Structure

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The modulated structure by high pressure and the superconductivity of YBCO compounds have been revealed over two decades [1]. However, their nature & mechanism are not yet sufficiently known. Continuing the achieved results [2-3], the present paper aims to evidence how the Quantum Electron-Magnetic Phenomenon, namely the Super-Exchange Interaction of the “active electrons”, i.e. the hybridized odd electrons from the Cu ions in the Cu-Y-Cu nanolayer as a Nanowaveguide (NWG), conditions the Superconductivity of YBCO. The 1st key: The nanostructure is of Quantum nature. The active electrons behavior as the Quasi-Free Electrons (QFEs) waving in the Quantum Well (NWG), where they can be favored to a strong Super-Exchange Interaction. Thereby, two types of the spin coupled pairs can be spontaneously formed in the NWG, where just the singlet pairs will play the role of the superconducting Cooper pairs. For studying these nanoeffects, ESR can offer an especially efficacious contribution. The 2nd key: On the basis of the consequences of the Pauli principle, the singlet pair only persists if its QFE cloud overlapping path length $L = nl/2$, where l is the de Broglie wavelength of QFE conditioned by the Nanodimension of the NWG (Fig.1, left). This electron waving status corresponds to an ideal metallic phase occurring in the NWG. The 3rd key: The spin coupling brings about a temperature depending Spin Gap of the QFEs in the NWG. Just this Spin Gaps causes the superconductivity with the phase transition characteristics (Fig.1, right) that exactly and surprisingly correspond with the experimental.

[1] Werner Buckel, *Supraleitung*, 5. Auflage, VCH Weinheim, New York, Basel, Cambridge, Tokyo (1994)., [2] Nguyen Van Tri, *Ferroelectrics*, Taylor & Francis Inc, USA, 305, 141-146 (2004)., [3] Nguyen Van Tri, *Acta Crystallographica A* 67 (suppl.), MS88.5, C193 (2011).

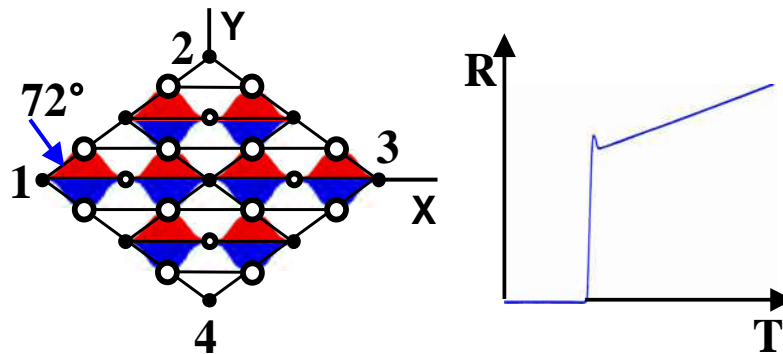


Fig. 1: Ideal metallic phase in the modulated nanostructure (left) and R-T transition diagram (right) of YBCO. 1,2,3,4 are the positions of the Cu atoms in the Cu- Y-Cu layer.

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