



**S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES**

Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

16th August, 2023

2.00 PM

ONLINE/ FERMION

SPEAKER

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TITLE OF THE TALK

ABSENCE OF SUPERCONDUCTIVITY IN LK-99 AT AMBIENT CONDITIONS

ABSTRACT

The report of synthesis of modified Lead Apatite (LK-99), with evidence of superconductivity at more than boiling water temperature, has steered the whole scientific community. There have been several failures to reproduce superconductivity in LK-99, albeit partial successes. Here, we have continued our efforts to synthesize phase pure LK-99, with improved precursors. The process has been followed as suggested by Sukbae Lee et. al.[1,2]. The phase purity of each precursor is evidenced by Powder X-ray diffraction (PXR) and well-fitted by Rietveld refinement. The PXR confirms the synthesis of phase pure polycrystalline LK-99 with Lead Apatite structure. The freshly synthesized sample does not show any signature of superconductivity viz. superconductor like levitation on a magnet or vice versa. Rather the levitation/repulsion hints towards complex magnetism. The magnetization measurements on SQUID magnetometer show that LK-99 is diamagnetic at 280K, and there is no sign of superconductivity in LK-99 at room temperature. The sample is highly resistive as well. Moreover, we have also performed first principle calculations to investigate the electronic band structure of the LK-99 in the vicinity of Fermi level. Our study verifies that the Copper (Cu) doped Lead Apatite (LK-99) exhibits bands crossing at Fermi level, indicating generation of strong correlation in the present studied system. Our results do not approve the appearance of superconductivity in LK-99, i.e., $\text{Pb}_9\text{CuP}_6\text{O}_{25}$ [3].

1. arXiv:2307.12008 (2023)

2. arXiv:2307.12037 (2023)

3. arXiv: 2308:03544 (2023)

HOST FACULTY

Prof. Tanusri Saha Dasgupta, Senior Professor
