

Colloquium

Superconductivity at extremely low carrier density: Bismuth

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Bismuth(Bi) has played a very important role in uncovering many interesting physical properties in condensed matter research¹ and continues to draw enormous scientific interests due to its anomalous electronic properties. Unlike metals where there is roughly one mobile electron per atom, in a semi-metal like Bi, the concentration of mobile electrons is extremely low (100,000 atoms share a single mobile electron). Hence, the superconductivity (SC) in bulk Bi is thought to be very unlikely at a currently achievable temperature ($\sim 40 \mu\text{K}$). In this talk, I will describe the first-ever observation of bulk SC in Bi single crystals (99.9999%) below $530 \mu\text{K}$ under ambient pressure with an estimated critical magnetic field of $5.2 \mu\text{T}$ (one eighth of earth's magnetic field) at absolute zero². The standard models (superconductivity) cannot explain this phenomenon because the characteristic thermal energy is comparable to the Fermi energy in Bi and a new theory is necessary.

References:

1. V.S. Edel'man, *Advances in Physics*, 25, 555 (1976) and references cited therein.
2. Om Prakash, Anil Kumar, A. Thamizhavel and S. Ramakrishnan, *Science* Vol. 355, Issue 6320, pp. 52-55 (2017).

Wednesday, Apr 12th 2017

4:00 PM (Tea/Coffee at 3:45 PM)

Seminar Hall, TCIS