6th B. M. Anand Memorial Lecture (Online)

Date: 15th December 2021.

Time: 11:00 a.m.

Speaker: Prof. *S. Ramakrishnan,* Distinguished Professor and Director, Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Mumbai 400 005

Title and Abstract:

Achieving ultra-low temperatures and Physics at those temperatures

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It is important to study the physics of materials at ultra-low temperatures since small interactions responsible for many quantum phase transitions get wiped out even at a normally achievable low temperature (4.2K) of liquid helium. Often new phase transitions are discovered at low temperatures, which prompts us to synthesize new materials which might show the same phenomena at higher temperatures leading to amazing applications. Therefore, it is of importance to study the physical properties of materials at ultra-low temperatures.

This talk, will describe the techniques to reach low and ultra-low temperatures and the investigation of phase transitions. The talk will describe the state of art nuclear refrigerator capable of cooling 5 Kg of Copper down to 0.000040 K built at TIFR. With this setup, superconductivity of Bismuth at 0.00053 K with a critical field of 0.000005 Tesla (one-tenth of earth's magnetic field) has been discovered [1,2].This was a surprising discovery as superconductivity of Bismuth at ambient pressure has the lowest carrier density(one conduction electron shared by 100,000 atoms) and attracted international attention.

1. Science, 355, No. 6320, pages 52–55 (2017)

2. Nature Physics (to appear in 2022)
