



# Physical Research Laboratory, Ahmedabad

## Colloquium 19-16

**Speaker:** Dr. Haranath Ghosh

Scientific Officer, Human Resources Development Section,  
Raja Ramanna Centre for Advanced Technology (RRCAT), Indore ;  
Faculty at Homi Bhabha National Institute (HBNI), Mumbai

**Title:** "High temperature Superconductivity in Fe-based materials; role of electronic structure studies"

**Time:** Wednesday, 04 December 2019, 16.00 hrs.

**Venue:** K.R. Ramanathan Auditorium, PRL

### Abstract

Superconductors are miracle Materials --- many surprising phenomena they exhibit, from zero resistance to quantum levitation. The race is on to make the first room temperature superconductor, several examples that room temperature superconductivity is a reality will be presented. Available high temperature superconductors may be classified into two categories; conventional (BCS) and unconventional (non-BCS) superconductors. Discovery of Fe-based superconductors is ground breaking and hints for a new path way to high temperature superconductors. The new materials feature FeAs layers instead of Cu-O layers of the famous cuprate high temperature superconductors. Antiferromagnetism in both systems appear from d- electrons, however, in FeAs systems they are much more mobile than cuprates. Unconventional superconducting pairing mechanism (yet to be settled), orbital physics, rich Fermiology, phase diagram and several distinctly different physical properties make them overall a fundamentally different class --- superconductors with not only high  $T_c$  but also with technological applications. A pedagogical introduction to the field will open the talk. Structural aspects and its intimate relation to electronic structure, orbital selective nature of various aspects like electron correlation, doping, Lifshitz transition and superconductivity will be emphasized. The latest developments in the field will be discussed along with various challenges in these classes of materials.

### The Speaker

Dr. Haranath Ghosh, obtained his Master's degree from Visva-Bharati University, Santiniketan, West Bengal and PhD from the Institute of Physics Bhubaneswar, Odisha. Dr. Ghosh is a well-known condensed matter theoretical physicist who has worked on various aspects of condensed matter physics starting from model studies to first principles *ab initio* studies. He is currently working at RRCAT, Indore. His research interest and contributions include density waves in solids, correlated electron systems,  $\pi$ -conjugated polymers, superconductivity & magnetism. Before joining to RRCAT Dr. Ghosh visited various universities and research centers in the capacity of post-doctoral fellow and guest scientist. He has worked at the Department of Physics, University of Arizona, USA; Max-Planck-Institute for Complex System, Dresden, Germany; University of Duisburg-Essen, Germany; Instituto de Fisica, Rio de Janeiro, Brazil and the National Institute of Material sciences (NIMS), Tsukuba, Japan to name a few. He was also visiting professor at the National Centre for Theoretical Sciences, Hsinchu, Taiwan and at the Department of Physics, Indian Institute of Technology, Kanpur, India. He has published around 100 research articles in various national & international journals. He is a reviewer of many international journals and the editorial board member of the American Journal of Physics and Applications.

**Tea at 15:30 hrs**  
**ALL ARE WELCOME**

