



## Superconductors: Properties, Technology, and Applications

Guest Editor:

**Dr. Tarapada Sarkar**

Department of Physics, University  
of Maryland, College Park, MD  
20742, USA

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### Message from the Guest Editor

So far, the copper oxide (cuprate) superconductors hold the record for the highest superconducting transition temperature ( $T_c \sim 133$  K) among all superconductors in ambient pressure. Therefore, to obtain room temperature superconductivity, it is crucial to understand the mechanism of the superconductivity in the unconventional high temperature superconductors. Since 1958, when the BCS theory was developed, it has been known that in low- $T_c$  superconductors, the conducting electrons of the material are bound together in “Cooper pairs”, a lower energy state that permits electrical conduction with no resistance. The binding of the Cooper pairs is caused by a coupling between the electrons and the thermal vibrations of the atoms themselves, a complex many-body quantum effect called the electron–phonon interaction. However, the electron–phonon scattering mechanism cannot explain the Cooper pairing found in unconventional superconductors. The question is: what is the pairing mechanism in high- $T_c$  superconductors? Therefore, understanding the mechanism of all superconductors remains one of the most important topics in condensed matter physics.





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### Prof. Dr. Ai-Qun Liu

1. Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic University, Hong Kong, China  
2. School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore 639798, Singapore

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*Micromachines* Editorial Office  
MDPI, Grosspeteranlage 5  
4052 Basel, Switzerland

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