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Editorial

What are *Quantum Materials*? These are materials exhibiting exciting physical properties dominated by quantum fluctuations, quantum entanglement, quantum coherence, topological behaviour, all of these being manifestation of quantum mechanical effects. Examples include superconductors, magnets, topological insulators, multiferroics among others. The research on *Quantum Materials* has received a worldwide attention in recent time. Dedicated multi-institutional, cross-country Centres and Hubs have been built, exploiting the expertise in varied discipline to answer how quantum technologies could transform our society. There is considerable interest among the top policy makers of our country in giving significant thrust and to create a conducive environment to carry out advanced scientific research and develop human resource and technologies. At the heart of Quantum technology are *Quantum Materials and Devices* which constitute the necessary platform to perform the quantum-enhanced tasks. The workflow relies on exploration of Majorana-based Quantum Computation, followed by concept realization in terms of designing of topological superconductors, superconductor/ferromagnet interfaces, oxide interfaces, etc. 'Shortlisting' of candidate materials, which would finally lead to Laboratory Growth and Characterization, calls for the need for collaboration between theory, experiment and simulation. Developing an understanding and making predictions pertinent to *Quantum Materials* need collaborative efforts between nano- and meso-scale science, advanced instrumentation, materials synthesis as well as modelling and simulation. The research on *Quantum Materials and Devices* is expected to provide solutions to the grand challenges in Quantum technology today. We envisage serendipitous fundamental discoveries in fields of high temperature superconductors, topological materials, fractional quantum Hall effect, graphene, etc., even while making technologically important contributions, such as scanning microscopy, ultrafast and multi-dimensional spectroscopic techniques, giant magnetoresistance materials, semiconductor heterostructures, spin and phase-change memory and opto-electronic devices, that are important in a wide range of sectors from defence and energy to entertainment. The importance of this field of physics has been widely recognized; for example, about half of the Physics Nobel Prizes in the last twenty years have gone to materials-related research.

In addition, the devices built on quantum-enhanced concepts, such as solid-state qubits, single photon emitters and detectors are key to multiple verticals in quantum technology, including quantum computing, quantum communication and quantum sensing. Significant emphasis needs to be placed on learning and optimizing the device processing steps and tools required for the reliable fabrication of quantum devices. The characterization and understanding of the physics of these devices, and testing their long-term stability are going to open up exciting opportunities in the coming future.

This Special Issue reviews theoretical and experimental advancements made to study quantum materials such as topological quantum materials, 2D semiconductors, correlated materials, and more. It will also discuss about the fabrication, characterization and physics of quantum devices, which is essential for enabling quantum technologies.

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