Symposium J : Quantum Materials Research: Current Trends and Future Directions

Scope of the Symposium

Depending on the composition, Quantum Materials may act as conductors, insulators, semiconductors or even as superconductors. In quantum materials, new particles or pseudo particles are created that have completely new characteristics. Quantum materials is a wide ranging term in condensed matter; it refers materials that present strong magnetic or electronic correlation and/or some type of electronic order (superconducting, magnetic order), or materials whose electronic properties are linked to non-generic quantum effects, such as emergent topological insulators, skyrmions, Dirac fermions, Kondo effect, and spin-polarization effects. The symposium on quantum materials intends to cover experimental and theoretical works on these subjects (but not limited to them), meanly focused on novel quantum materials candidates as well as their predictions and fundamental understanding. Quantum materials offer a new regime with new rules and new capabilities that open up possibilities for completely nonconventional devices. We can rethink the basics of electronics and photonics and introduce functionality that was previously impossible. Combinations of different quantum materials are of high interest to explore new phenomena and act as the foundation for future electronic, spintronic, and valleytronic devices at the nanometer scale. The foundation of quantum materials follows from materials that are ideally suited to layered atomic-scale structures that control the flow of charge and spin such as shown in graphene and the class of materials known as Topological Insulators. The exploration and synthesis constitute only one aspect of the challenges in the development of new topological materials, another challenge is their characterization. Since the phenomena appear at very restricted and dedicated conditions, the characterization method must have very high sensitivity, resolution, localization and precision. The analysis of quantum materials presents new challenges on how to minimize surface and sample damage while imaging and analyzing structures at or beyond the direct atomic level. New approaches are considered in order to correlate materials properties with structure. The symposium will address challenging aspects of characterization of quantum materials, as well as offer some insight into future research considerations.

Abstracts will be solicited in (but not limited to) the following areas

- *Quantum materials and devices: synthesis and characterization techniques*
- *Prediction of novel quantum materials: hightroughput, machine learning, and inverse design*
- *Hybrid quantum materials and heteroestructures*
- *New and developing analytical techniques, optical, x-ray, ions for quantum materials and quantum network development*
- *Structural and theoretical characterization of layered materials and topological insulators*
- *Strong correlated systems leading hosting quantum materials*

List of invited speakers

Maia Garca Vergniory (*Donostia International Physics Center, Donostia-San Sebastin, Spain; Ikerbasque Research Fellow, DIPC*) **Stephan Roche** (*Catalan Institute of Nanoscience and Nanotechnology*) **Luis E. F. Fo Torres** (*Departamento de Fsica, Facultad de Ciencias Fsicas y Matematicas, Universidad de Chile*) **Young-Woo Son** (*Korea Institute for Advanced Study*) **Qihang Liu** (*Shenzhen Institute for Quantum Science and Engineering (SIQSE) and Department of Physics, Southern University of Science and Technology*) **Felipe Crasto de Lima** (*Brazilian Nanotechnology National Laboratory (LNNano/CNPEM)*) .

Symposium Organizers

Carlos Mera Acosta (*UFABC*) **Adalberto Fazzio** (*LNNano - CNPEM*) .

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