Title: Quantum Materials by Design

Abstract:
Major advances in human civilization are driven by developments in materials. This is such a remarkable feature that historical eras are named after the material (and the related technology) that dominated that time. Today we live in the silicon era: Silicon technology enables our modern way of life via mobile phones, computers, automation. However, we are reaching the limits of silicon technology, as the related energy demand is not sustainable. It is time to move forward. As a scientists, we work to answer the question: what is the material that will enable the next revolution?

In this lecture, I will introduce a possible way forward: quantum materials, namely materials where quantum behavior is visible at macroscopic scales and, hence, can be used as a basis for developing quantum technologies. Using the predictive power of first-principles techniques, I will explain how to understand, control and design quantum materials and how to exploit the quantum effects emerging at reduced dimensionality and at interfaces to achieve dissipationless (topological) carrier transport, tune charge and spin relaxation processes, or identify spectroscopic signatures of defects in 2D layered materials.

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