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Quantum Materials, Devices, and Systems at 20 Years of NNI*

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Abstract

The discovery of quantum materials has created new opportunities for electronics and photonics. Quantum devices composed of a single atomic layer of graphene display ballistic transport and quantum behavior at room temperature. Quantum layered materials with a wide range of properties are provided by transition metal dichalcogenides, which can be metals, semiconductors, and superconductors, which function as electronic, magnetic and optical materials. Data channels are provided by the edge states that circle topological insulators in zero applied magnetic field. Color centers in diamond provide long-lived qubits at room temperature. Quantum materials, devices, and systems promise to advance the frontiers of sensing, communication, and computing.

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