

Thin Film Nickelates : A New Frontier for High-Temperature Superconductivity

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Superconductivity plays a key role in many next-generation technologies, including quantum computing and sensing. The promise of discovering new superconductors with higher transition temperatures has been at the forefront of research in condensed matter physics, materials science, and solid state chemistry for the past 4 decades. From the high temperature cuprate superconductors of the 1990s, to the iron-based superconductors of the 2010s, significant attention has now been directed in the past few years to the nickelate families of superconductors: the so-called “infinite layer” nickelates as well as the recently discovered bilayer nickelate, $\text{La}_3\text{Ni}_2\text{O}_7$.

In this seminar, I will describe recent advances in the study of the infinite-layer and bilayer nickelate superconductors. I will highlight new thin film synthesis approaches developed by our research group to synthesize infinite-layer nickelates, and investigate their phase diagram, including the nature of possible charge ordering in these materials, and also study the possibility of superconductivity in the undoped parent compound. Finally, I will describe our recent work on the bilayer nickelate $\text{La}_3\text{Ni}_2\text{O}_7$, and investigate the nature of the parent spin density wave order in this new high-temperature superconductor.