**Oxygen Defects and Superconductivity in Bilayer Nickelates**

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The recent discovery of high-temperature superconductivity in pressurized bilayer La₃Ni₂O₇₋δ has revitalized interest in Ruddlesden–Popper nickelates [1]. However, oxygen-driven structural inhomogeneity remains a critical barrier to synthesizing high-quality samples needed for definitive studies of their physical properties. In this talk, I present a breakthrough electron microscopy imaging technique capable of quantifying oxygen concentration at the atomic scale—resolving a long-standing challenge in oxide characterization [2,3]. We directly visualize oxygen vacancies and interstitials in bilayer nickelates and correlate these defects with local electronic structure using atomic-resolved electron energy-loss spectroscopy (EELS). This combined approach establishes how oxygen defects suppress superconductivity and reveals their interplay with charge distribution. Further, we demonstrate how this method unravels 3D structural distortions and pinpoints their role in material functionality.

References

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