Superconductivity and magnetism in infinite-layer nickelate heterostructures

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Nickel and copper are nominally very similar in chemistry so the search for superconductivity in nickelates is a story as old as the quest to understand the high temperature superconductivity of the cuprates.

In this talk, I will introduce the recent discovery of superconductivity in infinite-layer nickelates [1] and the ever-growing family of nickelate superconductors. I will touch on some of the materials challenges involved before summarizing the key physics we have learned so far including results from x-ray scattering [2] that identify a Mott-Hubbard-like character to the infinite-layer nickelate electronic structure as well as a significant rare earth 5d influence at the Fermi level. In particular I will focus on muon spin rotation [3] that reveals local magnetism in these materials that 1) onsets at rather high temperature, 2) is independent of the rare earth 4f electrons, 3) appears to be robust to doping 4) is antiferromagnetic and possibly short-range-ordered in nature and 5) coexists with superconductivity at low temperatures.

Finally, I will come back to the comparison between nickelates and cuprates and discuss how the disparities in the magnetic properties may be understood.

[1] D. Li et al, Nature **572**, 624 (2019).
[2] H. Lu et al, Science **373**, 213 (2021).
[3] J. Fowlie et al, Nat. Phys. **18**, 1043 (2022).

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