PARADIM – an Incubator for Collaborations III

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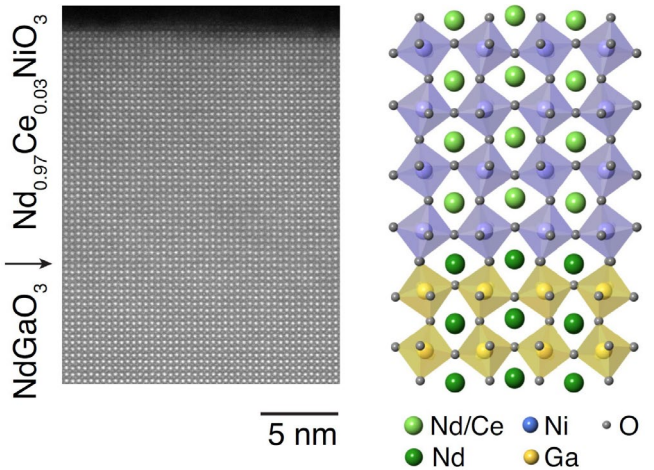
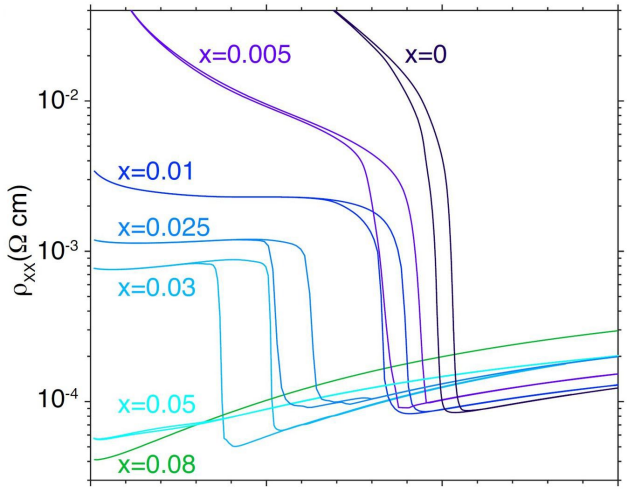
A team of experimentalists and theorists connecting at PARADIM have discovered a new antiferromagnetic metal. Their discovery adds to the rich variety of physical properties exhibited by rare-earth nickelates: superconductivity (previously discovered by the core members of this team), metal-insulator transitions, and antiferromagnetic insulators. This latest discovery provides additional insights into the coupling of spin, charge, and lattice degrees of freedom when these elements are combined.

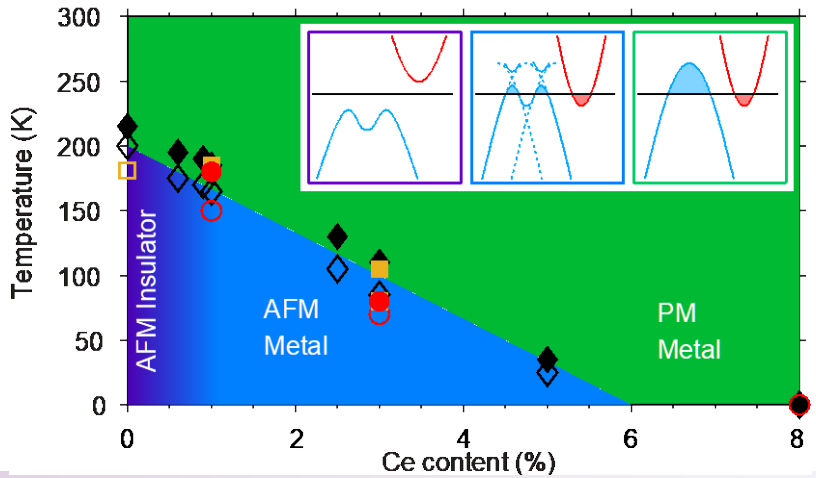
The addition of a small concentration of cerium atoms results in low electron doping and preserves the magnetic order on the nickel site while electronically a new metallic phase is induced. **ARPES measurements as well as *ab initio* calculations supported by PARADIM's Theory Facility** confirm the distinctive electronic structure of this new phase. Of potential relevance to spintronics applications, this work demonstrates write-read of the spin structure via a large zero-field planar Hall effect.

The social and knowledge sharing aspects of this discovery reveal the creative power of the PARADIM Platform. At the core of this team lies the strong collaboration between synthesis (Mundy) and theory (Botana), but for this work the team has reconfigured to include a former PARADIM Staff member (Moreschini), a former PARADIM student (El Baggari), and a PARADIM user (Heron).

Q. Song, S. Doyle *et al*. *Nature Physics* **19**, 522–528 (2023).







(Top left) Atom resolution STEM image of the new material and its interface with the substrate, (Top Center) Structure model shown for comparison. (Top right) Resistivity *vs*. temperature for various $Ce_xNd_{1-x}NiO_3$ films.

(Bottom) Electronic and magnetic phase diagram extracted in this study and various methods.