ASU Department of Physics
Arizona State University

COLLOQUIUM

Thursday, September 8th, 2022

4:00 PM – 5:00 PM, PSF 101

The Nickel Age of Superconductivity

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Abstract:

The physics behind high-temperature superconductivity in cuprates remains a defining problem in condensed matter physics. Among the myriad approaches to addressing this problem has been the study of alternative transition metal oxides with similar structures and electron count. After a 30 year quest, a non-cuprate compound with a cuprate-like structure that exhibits superconductivity has been found: hole-doped NdNiO2. Given that this material is one of the members of a larger series of layered nickelates, this result opens up the possibility of finding a new family of unconventional superconductors. By means of electronic structure calculations, we have analyzed the similarities and differences between this family of low-valence planar nickelates and cuprates. Even though these nickel oxide materials possess a combination of traits that are widely considered as crucial ingredients for superconductivity in cuprates (a square-planar nature, combined with the appropriate 3d-electron count, and a large orbital polarization) they also exhibit some important differences (a larger p-d energy splitting, and lack of magnetism in the parent compounds). Our results show that low-valence layered nickelates offer a new way of interrogating the cuprate phase diagram and are singularly promising candidates for unconventional superconductivity.

Biography:

Antia Botana is an assistant professor in the Department of Physics at ASU. Prior to joining ASU, she was a postdoctoral fellow at Argonne National Lab and at the University of California, Davis. She is the recipient of an NSF CAREER award and a Sloan Research Fellowship. Her research employs electronic structure methods to direct the computational design of materials with novel functionalities. She works on topics ranging from superconductivity to frustrated magnetism, thermoelectricity, and confinement effects in nanostructures.

Host: Prof. Onur Erten

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