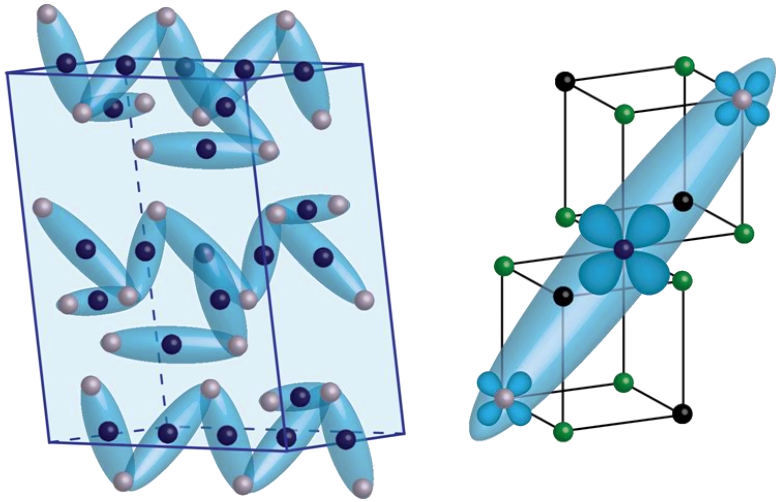
Unlocking the Secrets of Metal-Insulator Transitions

Beamline: CSX



The left image shows a monoclinic unit cell of magnetite with trimerons representing the electronic order and lattice distortions, while the image on the right shows the charge and orbital ordering associated with the trimeron.

R Kukreja, N. Hua, J. Ruby, A. Barbour, W. Hu, C. Mazzoli, S. Wilkins, E.F. Fullerton and O. G. Shpyrko, *Phys. Rev. Lett.* **121**, 177601 (2018).

Work was performed in part at Brookhaven National Laboratory

Scientific Achievement

Scientists revealed a two-step process underlying the metal-insulator (Verwey) transition in an archetypal strongly correlated material.

Significance and Impact

Understanding the characteristic timescales and length scales of the electronic, magnetic, and structural properties of correlated materials is essential for future applications of oxide electronics.

Research Details

- X-ray photon correlation spectroscopy experiments at NSLS-II's CSX beamline showed slowing down of orbital fluctuations near the Verwey transition temperature.
- The revealed two step process included a speeding up phase followed by an unexpected slow down.
- Slow down is concomitant with the decrease in correlation length for orbital ordering & the amount of insulating phase in the sample, resulting in pinning of the remaining orbital ordered domains.