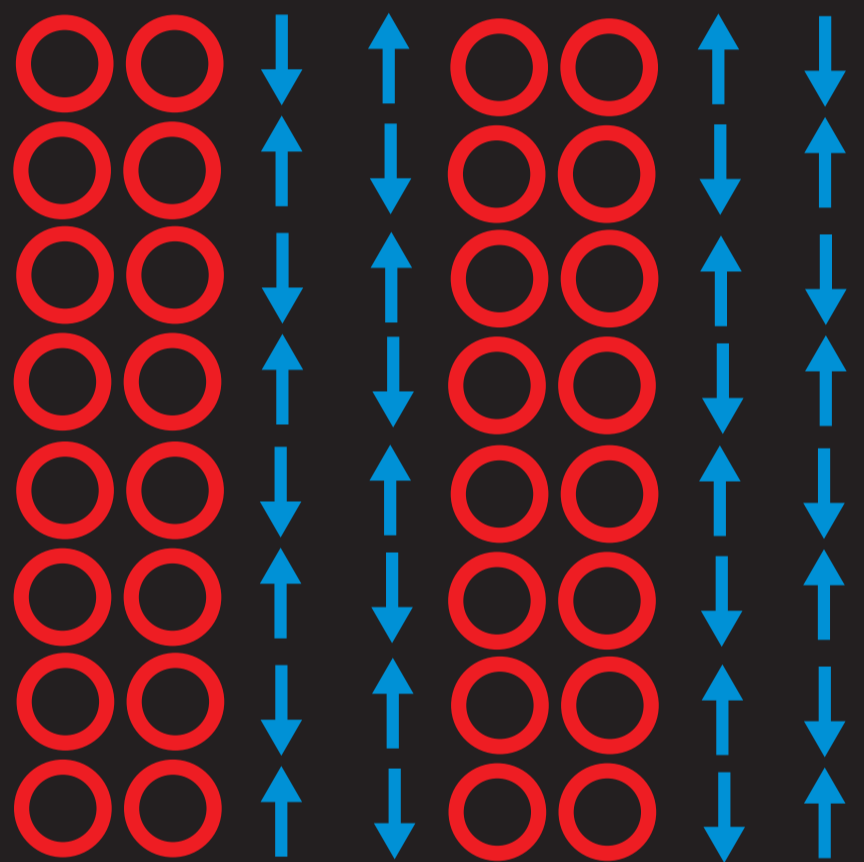


John Tranquada

“Seeing Stripes: Competition and Complexity in High-Temperature Superconductors”

John Tranquada is a Senior Scientist in the Physics Department at Brookhaven National Laboratory. He joined the Neutron Scattering Group as a novice in 1987, and became group leader in 1998. One of his first neutron experiments was the determination of the antiferromagnetic structure of $\text{YBa}_2\text{Cu}_3\text{O}_6$. In the mid-90's he was involved in the discovery of stripe order, first in layered nickelates and shortly afterwards in cuprates.

Superconductivity in layered copper-oxide compounds is remarkable not only because it survives to relatively high temperatures, but especially because it appears when mobile charge carriers are doped into a parent antiferromagnetic insulator. The tendency of the carriers to reduce their kinetic energy by delocalizing competes with the magnetic superexchange between spins on copper ions. One possible consequence of this competition is the segregation of carriers into charge stripes that separate antiferromagnetic domains. An ordered stripe phase has been observed by diffraction experiments in a few special cuprate compounds, and stripe order is found to compete with superconductivity. It has been proposed that quantum-disordered stripes might underlie the superconducting phase. Such a concept clashes with the conventional picture of electronic structure in solids. Some of the challenges of experimentally “seeing” both static and fluctuating stripes will be discussed.



Cartoon of charge stripes and antiferromagnetic domains.

NOTE TIME CHANGE: 11:00 a.m.

Wednesday, December 1, 2004

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