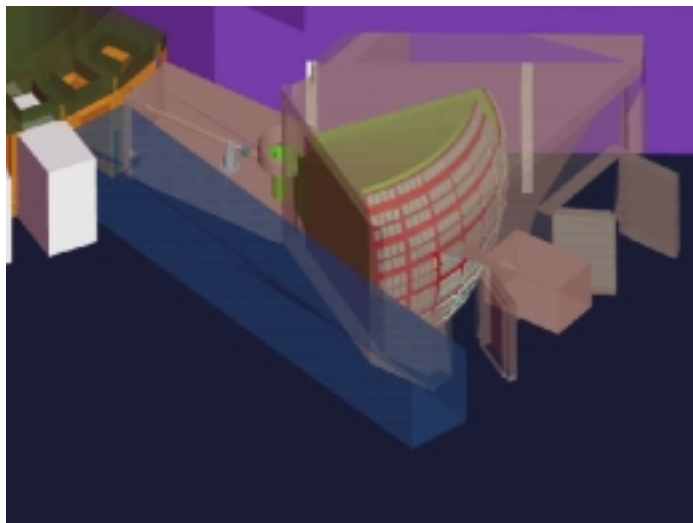


BRENT FULTZ



Schematic drawing of the ARCS spectrometer, proposed for construction at the Spallation Neutron Source. Red grid holds detector tubes, open doors towards right show scale.

The group headed by Brent Fultz is studying the arrangements and dynamics of atoms in materials by scattering methods using x-rays, electrons, neutrons, and γ -rays. Coherent elastic scattering, for example, reveals atom arrangements. Coherent inelastic scattering provides the energy-wavelength relationships of elementary excitations in solids. Identifying the positions of atoms and their movements is a general theme for Fultz and his group.

Most of what we know about atom arrangements in materials comes from diffraction measurements, where an incident plane wave is directed into a sample and the angles and intensities of the outgoing diffracted waves are detected. Fultz's group is exploring a novel method of γ -ray diffraction, where an incident γ -ray is absorbed by identical nuclei in a crystal. The decay of this nuclear exciton creates a new γ -ray photon with the angular distribution of a diffraction pattern. The physical process of scattering is fundamentally different from that of x-ray diffraction, and therefore offers new opportunities for studies of the atom arrangements in materials. For example, we are using the chemical spectroscopic information of Mössbauer spectra to control the phase and intensity of wave emission from selected nuclei in a sample.

A major topic of Fultz's research is how atom vibrations affect the entropy and thermodynamic stability of materials. "Vibrational entropy" is new to the materials science community, and its importance was unexpected. Fultz's group is now measuring phonon spectra of materials by inelastic neutron scattering to understand the reasons for differences in vibrational entropy of different solid phases. Recent studies have identified effects on vibrational dynamics from chemical disorder and local distortions around impurity atoms. The field of inelastic neutron scattering is a broad one, and a field that will grow in the U.S. with the construction of the Spallation Neutron Source. Fultz is the principal investigator on a proposal to build the inelastic neutron instrument shown in the figure.