Subject: MSD Colloquium, David P. Belanger, University of California, Santa Cruz, The Random-Field Ising Model: Critical Behavior in a Nonequilibrium Phase Transition, Thursday, May 22, 2008, 11:00 a.m., Building 212, Room A-157, Michael Pierce
From: Marlene Metz <metz@anl.gov>
Date: Tue, 06 May 2008 11:33:43 -0500
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MATERIALS SCIENCE COLLOQUIUM

SPEAKER: David P. Belanger
University of California, Santa Cruz

TITLE: "The Random-Field Ising Model: Critical Behavior in a Nonequilibrium Phase Transition"

DATE: Thursday, May 22, 2008

TIME: 11:00 a.m.

PLACE: Building 212, Room A-157

HOST: Michael Pierce

Refreshments will be available at 10:45 a.m

Abstract:

One of the most important and studied models of randomness is the random-field Ising model, in which spins point along one favored direction in a crystal and a small magnetic field is applied at each spin site with random direction. An excellent realization of this model is found in a dilute anisotropic antiferromagnet when a uniform field is applied along the favored spin direction. Such a random magnetic field, no matter how weak, is expected to destroy the phase transition for two dimensional Ising systems. Experiments on real systems show that this behavior occurs in equilibrium. For three dimensions, the situation is much more complicated and interesting. There is now a widely held consensus that a phase transition occurs for three dimensions. However, despite a tremendous amount of work, its nature is not yet very well understood theoretically. Various experiments on Fe0.85Zn0.15F2 with applied magnetic fields H ? 11T have shown, upon heating, critical behavior very close to the transition, with reduced temperatures as small as t=10-4. The critical exponents obtained by fitting these data satisfy the Rushbrooke scaling relation in the same way that those from an equilibrium 2nd order phase transition do, albeit with very different exponent values. Yet, despite the beautiful critical behavior obtained upon heating, the slightest decrease in temperature near the phase transition reveals severe hysteresis, showing the system to be very far from equilibrium. The very unusual ordering process that takes place when cooling the sample from above will be described and its probable relationship to the nonequilibrium behavior will be discussed.