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Aneesur Rahman Prize for Computational Physics Talk: Numerical Simulations of Spin Glasses and Related Systems

A. PETER YOUNG, University of California Santa Cruz

Systems with disorder and "frustration" occur in many branches of science. There has been considerable effort to understand one such type of system, known as the "spin glass", because it can be probed in fine detail experimentally by applying a magnetic field, and because it can be modeled by simple-looking Hamiltonians which are amenable to numerical simulation. Analytical work is very difficult and has been carried out mainly on models with unphysical features such as infinite-range interactions. Hence, much of what we know about spin glasses and related systems comes from numerical simulations on simplified models. In this talk I will describe some of the difficulties in performing *reliable* spin glass simulations. Then I will discuss several questions concerning phase transitions in spin glasses and related systems that have been addressed by simulations in recent years including (i) whether there is universality, (ii) whether there is a "vortex glass" transition in a disordered type-II superconductor in a magnetic field, (iii) whether "chiralities" play a crucial role in Heisenberg spin glasses, and (iv) whether there is a line of transitions (AT line) in a magnetic field.