ARTIFICIAL INTELLIGENCE LABORATORY

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PHYSICS OF COMPUTATION SEMINAR

Date: Monday, February 10, 1997
Time: Refreshments at 2:15pm
Talk at **2:30pm**
Place: NE43-518

Bulk Spin Resonance Quantum Computation

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Quantum computation remains an enormously appealing but elusive goal, appealing because of the promise of implementing superfast algorithms such as finding prime factors in polynomial time, but elusive because it is necessary to prevent environmentally-induced decoherence in the quantum bits while simultaneously making them available externally to load, perform, and read-out the computation. Experiments to date have used a small number of degrees of freedom (such as trapped ions) that have been carefully cooled to their ground state, but such approaches have been very difficult to scale beyond two bits. I will introduce a very different experimental domain for quantum computation that fixes these problems by using a bulk thermal ensemble (such as a liquid) to represent quantum information. Although such a system might appear to violate the requirements for quantum computation, small perturbations in the state of the liquid can behave as pure states, sequences of RF pulses can make use of the nonlinearity in interactions between spins to perform logic, ensemble observables can determine the results of a quantum algorithm such as factoring, and the enormous redundancy lets continuous measurements be performed, with quantum coherence times of up to thousands of seconds. A complete prescription will be given for the RF pulses that are used to program such a spin ensemble computer.

Host: Norm Margolus

This talk is part of a seminar series on adapting computers and computations to the constraints of, and opportunities afforded by, microphysics; and on the development and application of the physical theory of computation and information. If you would like to receive electronic notice of these seminars, send email to "poc@im.lcs.mit.edu."

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