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Albuquerque Meeting Brings News of Supercomputer Advances FREE

Robert R. Borchers

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"The thing that usually happens," he continued, "is (that) the whole system will make a dramatic transition from one phase to the other, and then if you wait a while it might actually make a transition back again." The system makes the change of state without changing temperature.

These computations require a degree of patience. To dectect an oscillation between two metastable states "might take a few days or a week in continuous simulation," said Christ, "but you'll see it."

One unit of microcanonical time for Christ's machine corresponds to about three hours of human time and updates the gluon field at each lattice point 120 times. A good calculation, according to Christ, requires 2000 to 3000 units of macrocanonical time or about one year of human time.

The nice thing about having a dedicated parallel computer to run such calculations is that machine time is available 24 hours a day, 365 days a year. Said Christ, "That means that we can push a little harder on all the parameters that make the calculation more difficult. We can go to lighter quark masses. We can go to bigger volumes."

Christ has also found evidence of chiral symmetry that accompanies the QCD phase transition just mentioned. Chiral symmetry, according to Christ, means that right-handed and left-handed quarks do not interact with each other. In other words, one quark cannot change the spin direction of another quark.

"Chiral symmetry has enormous physical consequences," Christ said. "It predicts that the pion should be very light. If you look at the particle spectrum, the lightness of the pion is a real paradox. This explains it, but it only explains it if this symmetry is spontaneously broken.

"In fact, the phase transitions we're discussing that take you to this quark-gluon plasma are most precisely described as a Curie point—the point at which spontaneous chiral magnetization dissolves (and becomes disordered). And at that point, the pion acquires a mass. The whole system changes very dramatically."

Results

Christ and his coworkers have verified the confinement property of quarks—the principle that quarks do not exist outside of bound states in pairs and triplets. Christ said that this property was observed experimentally, but not shown directly from the theory, until scientists started doing lattice QCD calculations.

Some quantitative predictions Christ would like to make accurately in the future are: the mass of the proton, the ratio of the nucleon mass to the ρ meson mass, the critical temperature of the phase transition, and the order of the phase transition, which appears to depend on factors such as the quark mass parameter.

There are other computers being employed for lattice QCD by groups of researchers in places such as Fermilab in Illinois, at IBM, in Japan, and in Italy.

Christ thinks that his advantage lies in the power of his parallel computer and the fact that it is dedicated to lattice QCD. "We've been able to look at this QCD phase transition in a regime for physically light quark masses. I think we can take the quark mass down to the point where we're in the regime where nature is, to sufficiently small quark masses and sufficiently large volumes so that we're talking about a real thermodynamic phenomenon." ■

Albuquerque Meeting Brings News of Supercomputer Advances

Robert R. Borchers

Supercomputing '91 was the fourth and largest conference in what has become *the* series of conferences on high-performance computing. Total attendance exceeded 4000, including approximately 200 non-US participants. More than 1600 people registered for the technical program.

The Supercomputing '91 conference and exhibition (SC'91) took place from November 18 to 22, 1991, in Albuquerque, NM. The following report is drawn from a summary of the meeting that was supplied by Robert R. Borchers of Lawrence Livermore National Laboratory (Livermore, CA). Borchers served on the SC'91 steering committee. He was founding editor of Computers in Physics *and is currently a member of our Editorial Board.*

Supercomputing '91 consisted of three major activities: tutorials and workshops, technical programs, and exhibits. The technical programs were the major focus of attention. However, more than 700 people registered for the tutorial sessions, and the exhibition brought a number of major new-product announcements.

The topics of the tutorials covered the spectrum from parallel computing to high-definition TV. Workshops formed one of the technical program tracks. Workshop topics included parallel algorithms for molecular dynamics and Monte Carlo simulations.

Technical Program

In the technical program, there were 83 refereed contributed papers and seven invited talks. In addition to plenary events such as the keynote address, a variety of panel sessions and minisymposia were held on specialized topics such as supercomputing in high school education.

This year's plenary speaker was D. Allan Bromley, Director of the Office

of Science and Technology Policy and President Bush's Science Advisor. His talk focused on the Federal High Performance Computing and Communications Initiative (HPCCI), which has strong Presidential and Congress backing. As has been discussed previously in *Computers in Physics* (see the May/June 1990 issue, p. 234), the HPCCI has four major thrusts: advanced hardware, high-speed networking, "grand challenge" applications, and education. Bromley touched on all of these areas and their importance to the economic health of the country.

Papers in the technical program ran the gamut from compiler technology to computational biology. Many other elements of the program have also become very popular, such as the visualization theater organized by Maxine Brown of the Electronic Visualization Laboratory at the University of Illinois, Chicago. This evening event assembled some of the best and latest computer visualizations.

As at most physics meetings, poster sessions are a regular event at the annual Supercomputing conference. But this series of conferences also features research exhibits, where individuals and institutions can demonstrate their work. Both were located on the exhibit floor, and featured in two evening sessions in conjunction with a reception in the same area. There were 38 research exhibits and 41 posters.

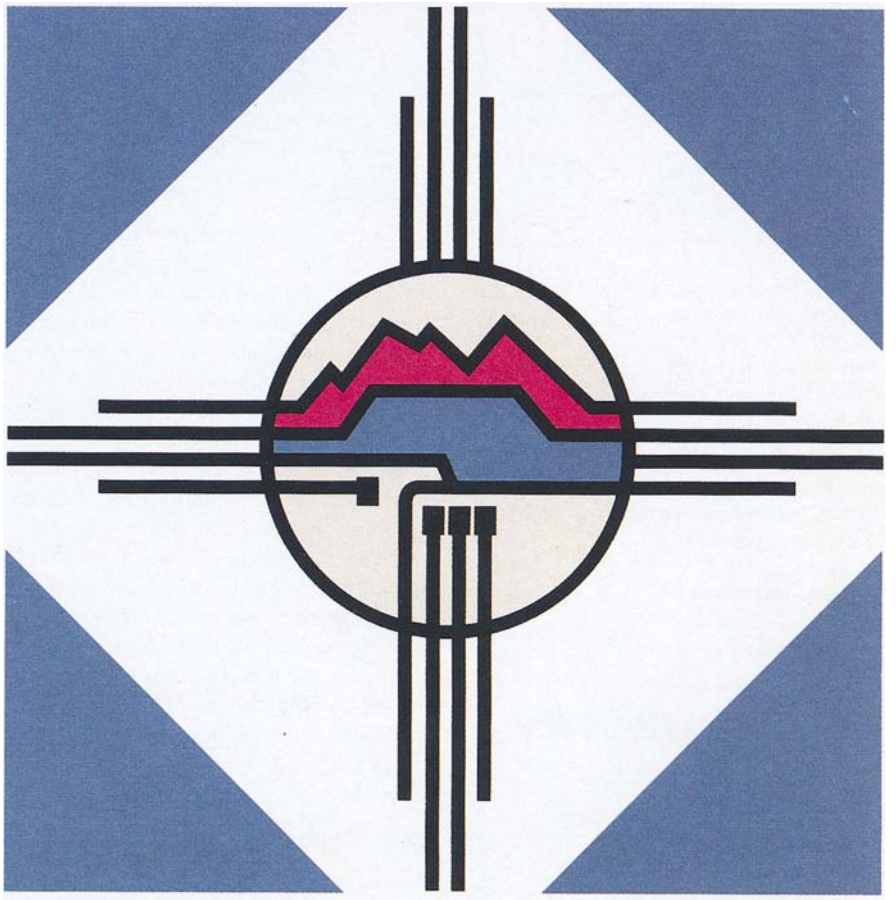
Industry Exhibits and Vendor Forum

A third part of the Supercomputing conference series is participation by all the major vendors of supercomputing and high-speed networking products. At SC'91, 63 organizations occupied booth space. The trade exhibits, together with the research exhibits and posters, filled the 100,000 square foot convention center floor. In an exhibit forum, 25 different vendors gave presentations largely focused on the future of high-performance computing and networking.

As a special attraction on the exhibit floor, the world's largest super-high-speed network (SCinet 91) was assembled and operated for the duration of the exhibits. With links operating at speeds of up to 1 Gbit/s, many of the vendors were connected, and links

SUPERCOMPUTING '91

NOVEMBER 18–22, 1991



ALBUQUERQUE CONVENTION CENTER

were established and demonstrated to both Los Alamos National Laboratory and Sandia National Laboratory.

There were a number of major product introductions. Both Intel Corp. (Beaverton, OR) and Thinking Machines Corp. (Cambridge, MA) announced new massively parallel systems with peak performance rated at around 100 Gflops. The Intel system is based on Touchstone Delta, a machine installed at CalTech for the Concurrent Supercomputing Consortium. It uses a high-performance version of the Intel i860 chip.

The new computer from Thinking Machines, Connection Machine 5, is the latest implementation of hardware to run this company's model of data parallel programming. It breaks with earlier Connection Machines in two important ways: (1) it has a multiple-instruction multiple-data architecture; (2) the processor at each node is a commodity SPARC microprocessor. The individual nodes of the CM5 will also contain proprietary "data path" chips for doing pipelined floating-point calculations.

In the vector-processing arena, Cray Research Inc. (Eagan, MN) formally announced the Y/MP C-90. This machine is the latest in the highly successful X/MP, Y/MP line. It fea-

NEWS

tures up to 16 processors operating at 250 MHz, yielding an overall capability of 16 Gflops.

Cray Computer Corp. (Pleasanton, CA) also had a booth at SC'91 (this company's first show participation anywhere), and was exhibiting the technology for the soon to be delivered Cray 3 system. The Cray 3 will use gallium arsenide logic, operate at 500 MHz, and have a peak speed, with 16 processors, of 16 Gflops.

Students

Since the first Supercomputing conference in 1988, the steering committee has put heavy emphasis on the involvement of students. At SC'91 a number of student volunteers from all over the country were given registration, copies of the proceedings, and access to all events, in return for working with the conference committee on the daily operation of the conference. These students in their distinctive tee shirts were a constant help and reminder of the importance of the next generation of computer and science professionals.

There were also a number of events involving the growing number of high-school programs, and even a special high-school day, which was attended by more than 100 students from all over New Mexico.

Next Meeting

Supercomputing '91 was jointly sponsored by the Special Interest Group on Architecture of the Association for Computing Machinery and the Computer Society of the Institute of Electrical and Electronics Engineers. Raymond L. Elliot of Los Alamos National Laboratory served as general chair, while Ken Kennedy of Rice University served as program chair.

A steering committee that includes representatives of many of the major institutions involved in high-performance computing, including NSF centers and DOE and NASA laboratories, meets to oversee and provide continuity to the Supercomputing series of conferences. The next Supercomputing conference will be held in Minneapolis, MN, on November 16–20, 1992. Supercomputing '93 will take place the following year in Portland, OR. ■

LETTERS

We invite you to mail your thoughts and comments to: Letters, *Computers in Physics*, 500 Sunnyside Blvd., Woodbury, NY 11797. Letters may be edited for length and clarity.

HCP Arrangements Give Identical Structures

In G. S. Pawley's article ("A simple model for the molecular dynamics of condensed phases," Sep/Oct 1991), six "different" two-dimensional structures composed of equilateral-triangle molecules are discussed and illustrated. It is pointed out that, for the special potential function chosen, all have the same potential energy and radiation distribution function. The reason for this is that all of the structures discussed in Section III and shown in Figs. 1–6 are identical. All are the hexagonal closest packing of atoms in a plane and differ only by where the lines marking out molecules are drawn. But since all have identical interatomic vector sets, the selection of certain vectors as bonds is meaningless. Homometric structures do exist (M. J. Buerger, *Vector Space and Its Application in Crystal-Structure Investigation*, John Wiley and Sons 1959, discusses them, as do many other books on crystallography), but this is not an example.

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Researchers Should Get Credit

The authors of the article "Real-Time Relativity" in your Jul/Aug 1991 issue wrongly identified our research done on relativistic rendering at Carnegie Mellon University as work done by *Science News* editor Ivars Peterson. The *SN* article by Peterson, which the authors of your article cited as original work, was obviously a story about our research. The *SN* article also gave references to our peer-reviewed papers.

REST-frame, the relativistic renderers we have developed, incorporates