Parallel Computing Research Newsletter CRPC

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Richard Matzner has a long-term interest in gravitation and in astrophysics. His earliest use of computational simulations included radiation spacetimes (e.g., radiation transport in supernovae) and studies of radiation around black holes, of nucleosynthesis, and of the pattern of anisotropies in the cosmic microwave background. His recent work has returned to the study of gravitational radiation from interacting black holes.

Astrophysical black holes are interesting because they are the strongest possible sources of gravitational radiation, and detectors to search for them (called LIGO and VIRGO) are under construction. The National Science Foundation has recently funded a "Computational Grand Challenge" for the theoretical study of black holes, involving investigators at eight universities. This project will develop software structures and tools and the computational science algorithms to evolve the black holes from an initial data specification, through a sufficiently long evolution to accurately extract waveform predictions at the outer surface of the computational cube.

Other aspects of gravitation and astrophysics have held Matzner's interest also. He has participated in a photographic observation of a total solar eclipse and is currently involved in space-borne experiments to measure relativistic effects. One such project is based on the LAGEOS laser-ranged satellite and could measure a subtle ("frame dragging") effect due to the rotation of the earth. Matzner also is on the Theory Working Group for the European Space Agency-proposed experiment called LISA, which is a space-borne interfrometric gravitational wave detector.

Matzner has authored or coauthored more than 120 scientific articles and has coauthored two books (he is an editor of one more, and of a series of lecture-transparency conference proceedings). His previous computational efforts have been dominated by algorithmic questions, developing adequate models for physical effects. The Grand Challenge project has brought with it a new interest in parallel computational architecture, and the data structure, communications, and informational databases to support very large-scale computing. Directing and participating in a large collaborative project has brought a number of management challenges as well.