Scott Klasky

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Research Interests

For the last nine years I have designed several major computer codes in the areas of physics, computer science, and numerical analysis. My main area of expertise is in designing large scale codes in the area of computational science. I have lead teams of researchers to develop state-of-the-art computer codes in the area of high performance scientific computing/physics. I have expertise on solving large scale Partial Differential Equations (PDE's), particularly for numerical relativity, using state-of-the-art techniques (Adaptive Mesh Refinement) as well as in designing collaborative visualization tools, to be used over the Internet. I have also designed Monte Carlo codes to price derivatives using a Path Integral Monte Carlo Approach.

Education

Ph.D., Physics *1994* — *University of Texas, Austin (Richard Matzner, Ph.D. supervisor)*

B.S., Physics *1989* — *Drexel University, Philadelphia (Joan Centrella, Undergraduate supervisor)*

Experience

Senior Research Scientist *12/95 to present* — *NPAC, Syracuse University, Syracuse*

Project Leader for four major computational research efforts:

- **Binary Black Hole Grand Challenge** (`http://www.npac.syr.edu/projects/bh/`). Team leader of the "ADM team" to design accurate and stable three-dimensional black hole evolution codes. (`http://www.npac.syr.edu/restricted/projects/bh/PROGRESS/CODES/ADM/adm.html`.)Management duties include software engineering, code development, code testing and leadership of the effort. Leader for the paralleization effort for this code onto platforms such as Cray's T3E, Origin 2000, IBM SP2, as well as clusters of locally distributed machines.
- **Rome Lab Weather Project** (`http://kopernik.npac.syr.edu:8888/weather/`). Project leader of small team of graduate students to bring visualizations of current U.S. weather, and supercomputing forecasts using state-of-the-art web technologies. Developing a collaborative visualization system for multi-dimensional codes that will run over the Internet. Technologies involved in these codes include Java, VRML 2.0, collaboration tools (TANGO), weather forecasting service codes (Unidata's LDM), etc.
- **Scientific Data Visualization** (`http://kopernik.npac.syr.edu:8888/weather/`). Project leader to develop a "state-of-the-art" visualization toolkit for computational researchers and students. This project has gained vast interest due to its usability, scalability, etc. This code is written in 100% Java and includes such features as collaborations, user-definable-filters, displaying 1D, 2D, 3D plots in a variety of modes. In addition users can animate graphs of all rank. Additional information can be found at the web site.

- **Financial modeling** (`http://terminator.npac.syr.edu:4761/Demo/history2.html/`). Involved with a collaboration of business and academic groups to develop a Monte Carlo code to price stock options. Several interesting features of this code include running on high performance computers (SP2) using MPI, Path Integral Monte Carlo Approach. I am the project leader of this group which includes a collaboration of researchers at Austin TX, and researchers at NPAC.
- **Supervision of graduate/undergraduate students**. Management and Supervision of graduate and undergraduate students: In the last 2 years at NPAC, I have supervised 3 undergraduates in the Research Experiences for Undergraduates in High Performance Computing at NPAC (http://www.npac.syr.edu/REU/). I have also supervised 1 Ph.D. student in physics, 1 Master's student in Computer Science, and 1 Ph.D. student in Computer Science. In addition I have supervised 4 other graduate student projects since I have been at Syracuse.

Post Doctorate Fellowship
09/94 to 12/95

University of Texas, Austin

Designed several numerical tools for the solution of large-scale PDE's including:

- A three-dimensional elliptic PDE solver for the initial value solution of the coalescence of two black holes. This code used state-of-the-art numerical techniques including: Multi Level Adaptive Techniques, Adaptive Mesh Refinement, Deferred Correction.
- General multi-dimensional interpolation schemes. These were written to be used on parallel and vector machines.
- Lead an effort to start the Texas black hole evolution group.
- Lead the design effort for multigrid support in the Distributed Adaptive Grid Hierarchy effort. Developed several efficient, parallel codes for this effort.

Research Associate
06/94 to 09/94

Center for Relativity, University of Texas, Austin

Designed a large scale PDE elliptic solver for the initial value problem for general relativity.

Research Associate
09/89 to 06/94

Center for High Performance Computing, University of Texas, Austin

Worked on visualizations for medical imaging including:

- Designed visualization techniques to show MRI's and CAT scans in three dimensions.
- Implemented a visualization technique to map from an abstract mathematical model, to the human body to display the spread of head and neck cancer.

Junior Physicist
1987,1988

Plasma Physics Laboratory, Diagnostics Division, Princeton University

Designed a large scale computer system for the diagnostic spectroscopy group working on plasma physics, which is still in use today. Large portion of the coding went into the reliability and maintains of this code.

Junior Engineer
1986

Dyna East Corporation, Philadelphia PA

Work on a two-dimensional finite-element code to help design non-nuclear warheads. Major efforts went into design of boundary conditions to help stabilize the existing codes.

Computer Experience

Hardware

- Silicon Graphics, Cray (C90,T90,T3D,T3E,J90,YMP), Sun Sparcstation, IBM SP2, Dec. Alpha clusters, VAX, Intel IPSC, IBM RS6000, IBM PC with Windows

NT, Windows 95, Linux, Apple Macintosh.

Software Languages

- Fortran 77, Fortran 90, HPF, MPI, C, Java, Perl, Maple, GL, Dore, SGI's explorer, AVS, CORBA.

Honors and Awards

Phi Beta Kappa Honors Society *1991*

University of Texas, Austin

Senior Honorable Mention *1989*

Drexel University, Philadelphia

Member and President of Sigma Pi Sigma, Physics Honor Society

Drexel University, Philadelphia

Proposals

Principal Investigator

WebFlow: A Visual Problem Solving Environment for Wide-Area, Heterogeneous, Distributed High Performance Computing.

A proposal to the National Science Foundation: New Technologies Program, June 14, 1996. With G. Fox, W. Furmanski, T. Haupt, S. Klasky, M. Chen, J. Cowie, J. Browne, M. Parashar. This proposal focussed on using an adaptive network of computers in an intranet to do large scale computing for highly adaptive problems.

Studies in Multi Level Adaptive Techniques for Numerical Relativity

A funded proposal to the Cray/Texas Supercomputing Grants at the University of Texas at Austin.

Co-Investigator

I have been a co-investigator on 6 grants which have been funded for time on NSF center supercomputing centers with (Matzner et. al.)

Recent Publications

1. "Java based Collaborative Scientific Visualization" (w/ B. Ki), Concurrency: Practice and Experience, accepted 1998.
2. "Schwarzschild-Perturbative gravitational wave extraction and outer boundary conditions" (w./ Abrahams et. al.), submitted to Phys. Rev. Letters 1997.
3. "Boosted three-dimensional black-hole evolutions with singularity excision" (w/ Cook et. al.), submitted to Phys. Rev. Letters 1997.
4. "The Binary Black Hole Grand Challenge ADM code", (w/ Cook et. al.), to be submitted to Phys. Rev. D, 1998.
5. "Collaborative Scientific Visualization" (w/ B. Ki), Concurrency: Practice and Experience, November 1997.
6. "Multigrid- An Approach in HPF" (w/ U. Dittmer), NPAC technical report (SCCS-772), 1996.
7. "Multigrid support with the `DAGH` package: Specifications and Applications" (w/

M. Choptuik et al.), *Site report, 1995*.

8. "A Technique for Tracking Apparent Horizons," (w/ M. Huq et al.), site report 1996.
9. "A Parallel Implementation of Multi-Grid in one dimension" (w/ R. Guenth er), (Site report, 1994).
10. "Visualizing Complex Patterns in the Spread of Head and Neck Cancers," (w/ L. Gray et al.), *The International Journal of Supercomputer Applications* **7**, 167 (1993).
11. "Three-dimensional initial data for the collision of two black holes," (w/ G. Cook et al.), Physical Review **D47**, 1471 (1993).
12. "Properties of gravitational "solitons" ", (w/ J. Centrella et al.), Physical Review **D43**, 379 (1991).

Recent Invited Talks
1995-1998

Throughout the last six years, gave the following major talks

- "Collaborative Scientific Visualization", ACM 1998 Workshop on Java for High-Performance Computing, Feb28-March1, 1998.
- "NPAC's role in collaborative tools for Scientific visualization", CEWES 1998.
- "New Features and enhancements in Scivis", Los Alamos BBH Grand Challenge meeting, 1997
- "An overview of the Binary Black Hole Grand Challenge effort", Syracuse Astronomical Society, 1997.
- "NPAC's Scientific Visualization System (Scivis)", Supercomputing 1997.
- "NPAC's Scientific Visualization System (Scivis)", NAVO, 1997.
- "NPAC's Scientific Visualization System (Scivis)", University of Southern Mississippi, 1997.
- "An overview of Scivis", ACM 1997 Workshop on Java for Science and Engineering Computation June 21-97 PPoPP Las Vegas, 1997.
- "Current Status Report on the ADM code in the Binary Black Hole Grand Challenge Effort", Los Alamos Workshop, 1997.
- "Stability Problems in the ADM code", Penn State University, 1997.
- "An Overview of NPAC's Scivis System", Penn State University, 1997.
- "Status and Future of 3D codes", Syracuse University, 1996.
- "Computational resource requirements", Syracuse University, 1996.
- "Current Status Report of the ADM Code in the Binary Black Hole Grand Challenge Effort", Syracuse University, 1996.
- "Syracuse & Texas effort on the collaborative hyperbolic ADM code", University of North Carolina, Chapel Hill, 1996.
- "TX's large scale black hole evolution code, imposing outer boundary conditions", University of Pittsburgh, 1996.
- "The Initial value problem of General Relativity, numerical solutions", Syracuse University, 1996.
- "Advanced Computational Techniques in numerical relativity", University of Texas @Austin, 1995.
- "High accuracy Interpolators", University of Texas @Austin, 1995.

References

Richard Matzner (richard@ricci.ph.utexas.edu)
Joan Centrella (joan@sparrow.drexel.edu)
Pablo Laguna (pablo@astro.psu.edu)