



Institute for Pure and Applied Mathematics
University of California, Los Angeles presents a program in

Grand Challenge Problems in Computational Astrophysics

Workshop III: Relativistic Astrophysics

May 2 - 6, 2005

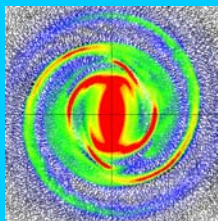
Members of the Organizing Committee include: **Richard Matzner**, Chair (Univ of Texas, Austin), **Curt Cutler** (Univ of Potsdam), **Michael Holst** (UCSD), **Richard Klein** (UC Berkeley/Lawrence Livermore National Laboratory), **Joseph Monaghan** (Monash Univ, Australia), **Ewald Mueller** (Max Planck Inst for Astrophysics), **Tsvi Piran** (Hebrew University) and **Stuart Shapiro** (UIUC)

Scientific Overview: *Relativistic astrophysics* presents a number of challenges: high relativistic factors, strong gravitational fields, uncertain equations of state, large dynamical range, solution in General Relativity of constrained hyperbolic systems. The complete description of the collimation of astrophysical jets is still being elucidated. Understanding the development of structure of the cosmic microwave background radiation (CMB) and the effect of primordial gravitational radiation on microwave polarization remains an active topic. Predicting source dynamics and detected gravitational waveforms is important to understand hoped-for observations in the current generation of gravitational wave detectors, and essential to achieve design sensitivity in future space-based detectors. Additionally there are analytical questions of formalism in relativistic dynamics that are not completely resolved, but demand consideration also at the discrete level. And there are extensions of these concepts to modern field theory and string theory, such as the understanding of gravitational structure in spacetimes constituting more than four dimensions; these are sufficiently complex that only a computational approach is feasible.

This workshop will be aimed at illuminating the computational techniques that have been successfully employed to investigate this range of problems, to identify what improvements might be made in those techniques, and to discuss and implement new approaches to remaining open questions in physics and astrophysics.

Areas to be considered include:

- *relativistic jets*
- *relativistic shocks*
- *black hole astrophysics*
- *gravitational collapse*
- *neutron star mergers*
- *black hole mergers*
- *gravitational waves: timing and spectroscopy*
- *challenges of LIGO, LISA*
- *cosmology, cosmic background radiation polarization*
- *gamma-ray bursters*
- *formulations of Einstein's field equations for numerical relativity*
- *numerical studies of higher dimensional black holes*



Semester Program Schedule:

Tutorials. March 8 - 11, 2005

Workshop I: Astrophysical Fluid Dynamics. April 4 - 9, 2005

Workshop II: N-Body Problems in Astrophysics. April 18 - 22, 2005

➤ *Workshop III: Relativistic Astrophysics. May 2 - 6, 2005*

Workshop IV: Transfer Phenomena. May 16 - 20, 2005

Confirmed Speakers: **Miguel-Angel Aloy** (Max Planck Inst for Astrophysics), **Joan Centrella** (NASA GSFC), **Matthew Choptuik** (Univ of British Columbia), **Jose Antonio Font** (Univ of Valencia), **Julian Krolik** (Johns Hopkins), **Hideaki Kudoh** (Univ of Tokyo), **Pablo Laguna** (Penn State Univ), **Luis Lehner** (Louisiana State Univ), **Lee Lindblom** (Caltech), **Andrew MacFadyen** (Princeton), **David Meier** (Caltech), **Tony Mezzacappa** (Oak Ridge National Laboratory), **Jerome Novak** (OBSPM), **Frans Pretorius** (Caltech), **Oscar Reula** (Univ Nacional de Cordoba), **Luciano Rezzolla** (SISSA/ISAS), **Mark Scheel** (Caltech), **Masaru Shibata** (Univ of Tokyo), **Anatoly Spitkovsky** (UC Berkeley), **Saul Teukolsky** (Cornell) and **Shing-Tung Yau** (Harvard)

Participation:

Financial support for this workshop is available for participants at all academic levels, and recent PhD's, graduate students, and researchers in the early stages of their career are especially encouraged to apply. An online application for support is available at <http://www.ipam.ucla.edu/programs/pcaws3>. Encouraging the careers of women and minority mathematicians and scientists is an important component of IPAM's mission and we welcome their applications. Applicants who are interested in becoming core participants and participating in the semester program (March 7 - June 10, 2005) should apply at <http://www.ipam.ucla.edu/programs/pca2005>.

Please visit our website at

<http://www.ipam.ucla.edu/programs/pcaws3>

or email questions to pcaws3@ipam.ucla.edu

IPAM is an NSF funded Institute