



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

# Grand Challenge Problems in Computational Astrophysics

## Workshop II: N-Body Problems in Astrophysics

April 18 - 22, 2005

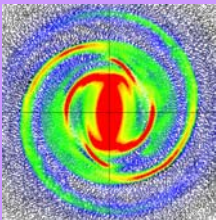
Members of the Organizing Committee include: **Ben Moore**, Chair (University of Zurich), **Sverre Aarseth** (Cambridge University), **Willy Benz** (University of Bern), **Geoff Bryden** (Jet Propulsion Laboratory), **Hugh Couchman** (McMaster University), **Piet Hut** (Institute for Advanced Study), **Ben Leimkuhler** (University of Leicester, UK), **Joseph Monaghan** (Monash University, Australia) and **Matthias Steinmetz** (Astrophysical Institute Potsdam)

**Scientific Overview:** The *N-body technique* has proved to be a powerful tool for investigating a diverse range of Astrophysical phenomenon from the formation and evolution of planetary systems, to the origin of galaxies and large scale structure of the universe. This workshop will bring together experts from many areas of astrophysics and mathematics who have a common interest in the N-body technique. We will begin with several introductory overview talks that will give the background for the rest of the workshop and present the scientific, algorithmic and hardware challenges faced by this community.

### The following topics will be discussed:

- *The dynamics of small and large N systems*
- *The formation and stability of planetary systems*
- *Smoothed particle hydro-dynamics as an N-body method*
- *Galaxy formation: collisionless dark matter, collisional fluids & star-formation*
- *Integration schemes and symplectic methods*
- *Long term integration: stability of the solar system*
- *The dynamics star clusters & black holes*
- *Test problems for the N-body and SPH methods*
- *Numerical convergence, stability and approximations*
- *Hierarchical mesh & Treecodes*
- *Parallelisation of the N-body technique*

The emphases of this workshop are: **1)** to illustrate the wide range of problems that can be addressed by the N-body technique, **2)** to air the various approaches taken to handle the wide range of spatial and temporal scales arising in such problems, **3)** to promote discussion of how codes necessarily adopting a limited value of N can be used to explore systems containing a far larger number of objects, and **4)** to explore the most successful approaches for inclusion of physics other than gravitation.



### 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:** *Sverre Aarseth* (Cambridge University), *Matthew Bate* (University of Exeter), *Walter Dehnen* (University of Leicester, UK), *John Dubinski* (University of Toronto), *Piet Hut* (Institute for Advanced Study), *Ralf Klessen* (Astrophysikalisches Institut Potsdam), *Wilhelm Kley* (University of Tuebingen, Germany), *Andrey Kravtsov* (Center for Cosmological Physics), *Ben Leimkuhler* (University of Leicester, UK), *Jun Makino* (University of Tokyo), *Rosemary Mardling* (Monash University, Australia), *Seppo Mikkola* (University of Turku), *Joseph Monaghan* (Monash University, Australia), *Ben Moore* (University of Zurich), *Wes Petersen* (ETH Zurich), *Simon Portegies-Zwart* (Sterrenkundig Instituut "Anton Pannekoek"), *Derek Richardson* (University of Maryland), *Shane Ross* (Caltech), *Volker Springel* (Max Planck Institute for Astrophysics), *Joachim Stadel* (University of Zurich) and *Scott Tremaine* (Princeton)

**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/pcaws2>. 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/pcaws2>

or email questions to [pcaws2@ipam.ucla.edu](mailto:pcaws2@ipam.ucla.edu)

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