

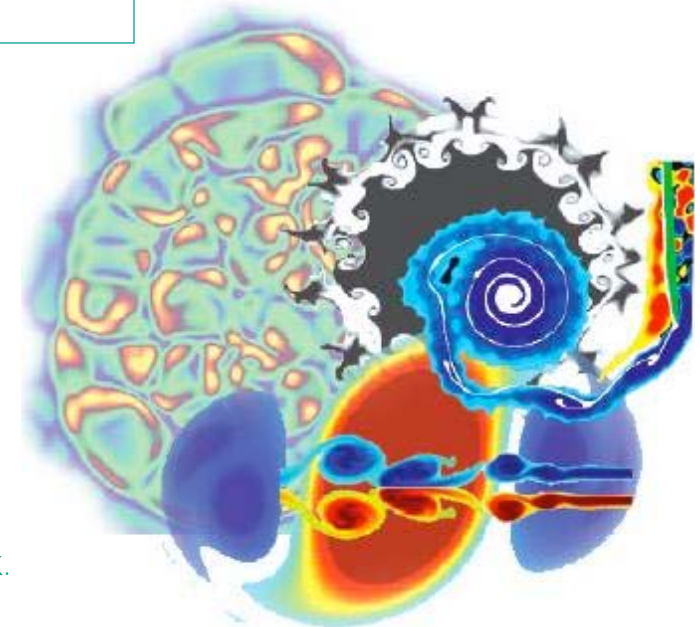
First European SCAT Workshop: *Advanced Computational Research*

Research Summary of SCAT partners

Lorena Barba

University of Bristol

(based on presentations given at SCAT launch, Feb.2006, Barcelona)



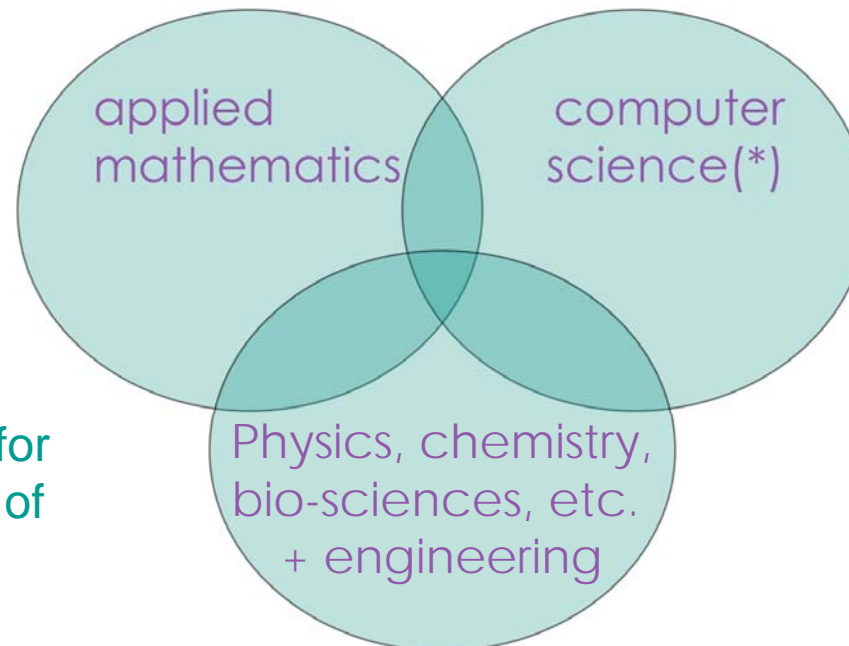
26-30 June 2006



First European SCAT Workshop
Daresbury Laboratories, Cheshire, U.K.

What is Scientific Computing?

- Solution of scientific problems using computers
 - It is a multidisciplinary activity →
 - “third pillar of science”
 - Next to experiments and analysis
 - Now a necessary avenue for enquiry in almost all fields of science and engineering /

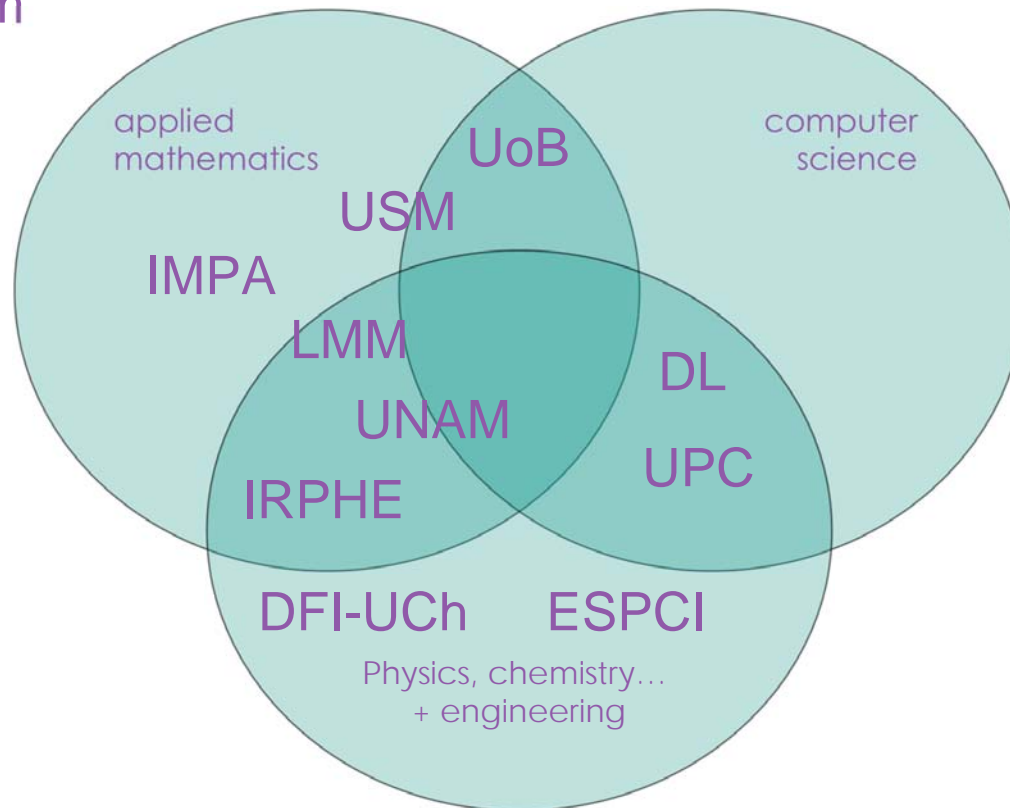


(*) meaning, software development, implementation, execution, profiling, optimizing...

SCAT partners

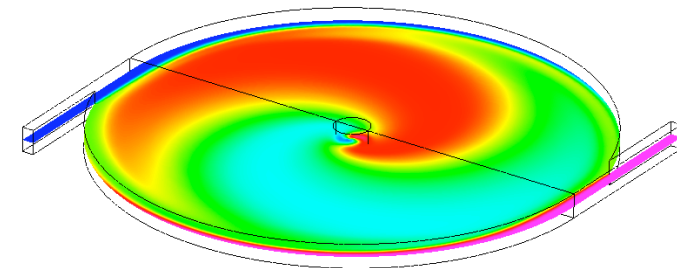
- Multidisciplinary team

- DL
- ESPCI
- LMM
- UoB
- IRPHE
- UPC
- DFI-UCh
- IMPA
- UNAM
- USM



Daresbury Laboratory (DL)

- Computational engineering
 - Turbulence and combustion, aerodynamics, environmental modelling
- Fluid dynamics
 - Free-surface and interfacial flows
 - Microfluidics
 - Rarefied gas dynamics
- High-performance computing
 - DisCo: giving academic groups unbiased advice, helping to understand tools, machines, performance
 - Software engineering: portability, grid computing



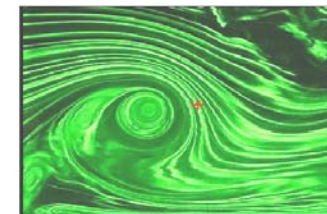
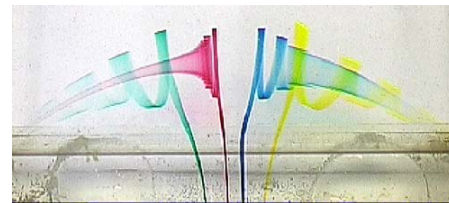
Simulation of a micro-vortex reactor for the Paterson Institute for Cancer Research

People: Mike Ashworth, Rob Barber, Miles Deegan, David Emerson, Xiaojun Gu, Christine Kitchen, Andy Sunderland.

École Supérieure de Physique et Chimie Industrielles (ESPCI)

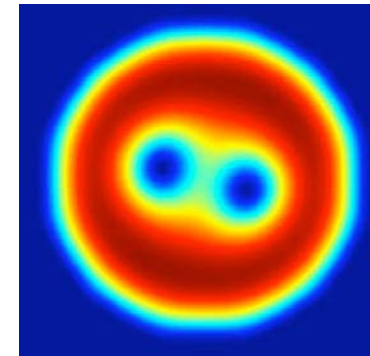
- Granular materials
 - Underwater sand ripples
- Elasticity
 - Propagation of elastic waves through dislocations
 - Propagation of Lamb waves in inhomogeneous waveguides
- Fluid dynamics
 - Flow control, bluff body wakes, passive scalar turbulence, structure and dynamics of vortex filaments
 - Temporal evolution of a vortex burst, turbulent cascade build-up

People: Agnes Maurel, Eduardo Wesfreid.



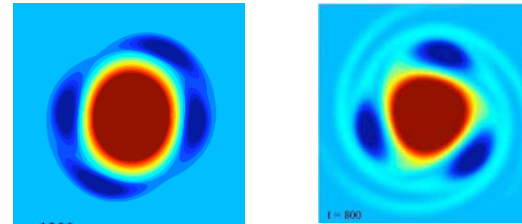
Laboratoire de Modélisation en Mécanique (LMM)

- Solid mechanics
 - Cracks and fracture
- Fluid mechanics
 - Turbulence, vortex flows, multiphase flows, free surfaces
- Granular systems
- Bose-Einstein condensates
- Numerical methods
 - Large-eddy simulation (sub-grid models)
 - Volume-of-fluid
 - Boundary-integral



People: Joel Frelat, Christophe Josserand, Pierre-Yves Lagre, Maurice Rossi.

University of Bristol (UoB)



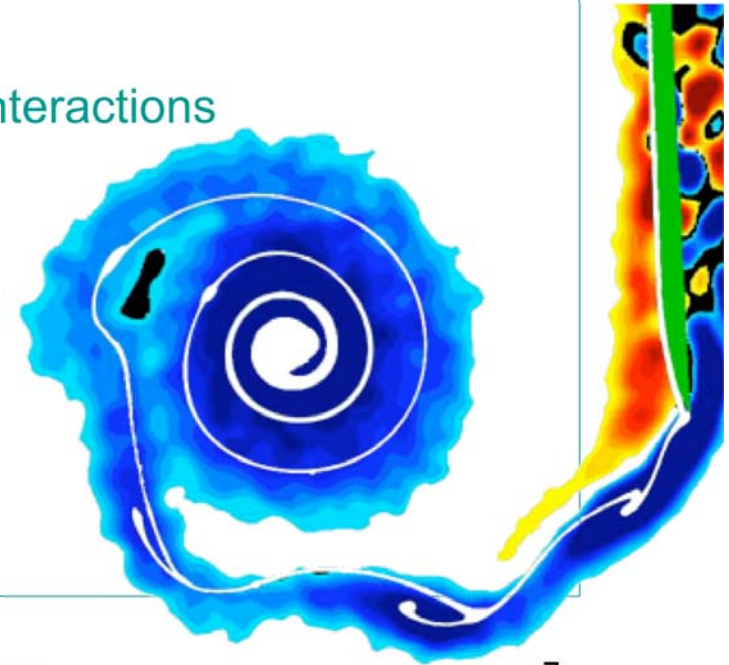
- Fluid dynamics
 - Vortex interactions and stability, mixing, vortex multipoles
 - Flow simulation using vortex methods
 - Free-surface flows, nonlinear dynamics and singularities, turbulent flow at very high Reynolds numbers
- High performance computing
 - Parallel programming techniques, Message Passing Interface, grid computing, graphics and visualization, profiling

People: Lorena Barba, Jens Eggers, Ian Stewart.

Institut de Recherche sur Phénomènes Hors Équilibre (IRPHE)

- Combustion, turbulence, interfaces
- Aerodynamics
 - Airplane wake vortices
 - Elliptic instability in aeronautical and geophysical flows
- Fluid dynamics
 - Vortex dynamics, wakes, fluid-structure interactions
 - Stratified flows, centrifugal instability
- Statistical physics
 - ... and dynamics of nanostructures
 - Protein folding problem
 - Kinetic and elastic driven instabilities

People: Malek Abid, Stephane Le Dizes, Patrice Meunier, Alberto Verga.



Universitat Politècnica de Catalunya (UPC)

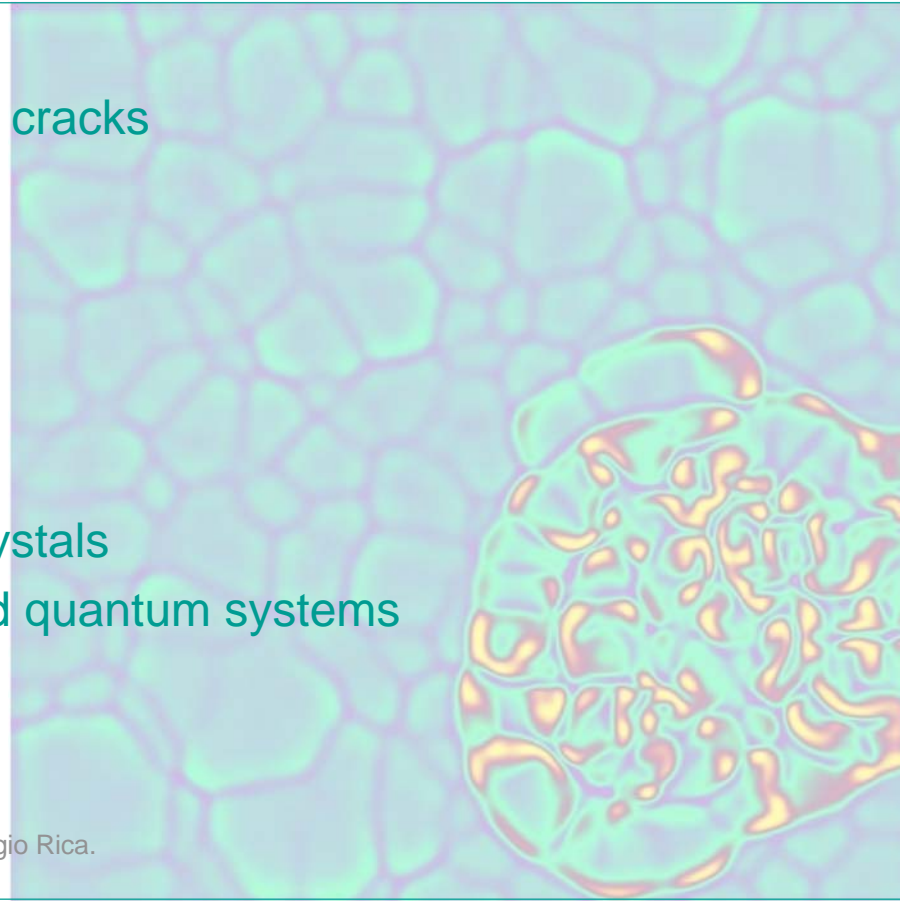
Centre Tecnològic de Transferència de Calor:

- Heat transfer
 - Direct numerical simulation of 3D natural convection in cavities
 - Solar thermal energy systems, absorption cooling, compressors
- Fluid dynamics
 - Wall-bounded flows in one or two directions
 - New turbulence modelling strategies
- Parallel algorithms for low cost parallel computers
 - Algorithm for Poisson equation with a single message
 - Maintainability, portability, performance, object orientation
 - Validation and verification of codes

People: Jordi Cadafalch, Ricard Consul, Assensi Oliva, Carlos Perez-Segarra, Manel Soria.

Departamento de Física, Universidad de Chile (DFI-Uch)

- Materials science
 - Elastic wave propagation, cracks
 - Elasticity of plates
- Granular materials
 - Granular avalanches
 - Drying a suspension
- Non-equilibrium systems
 - Nonlinear optics, liquid crystals
 - Properties of classical and quantum systems
- Superfluid models

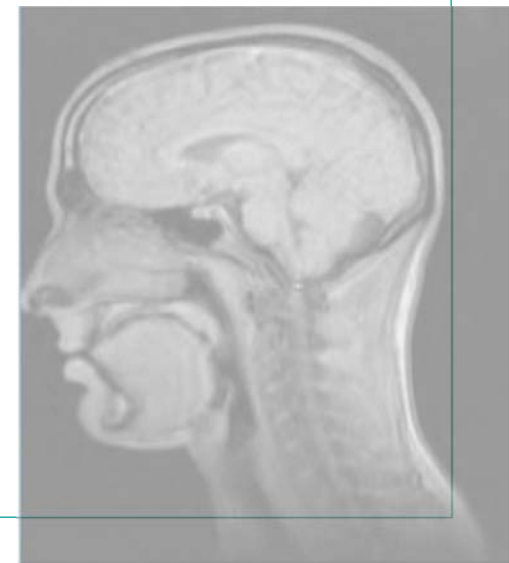


People: Felipe Barra, Marcel Clerc, Fernando Lund, Sergio Rica.

Instituto de Matemática Pura e Aplicada (IMPA)

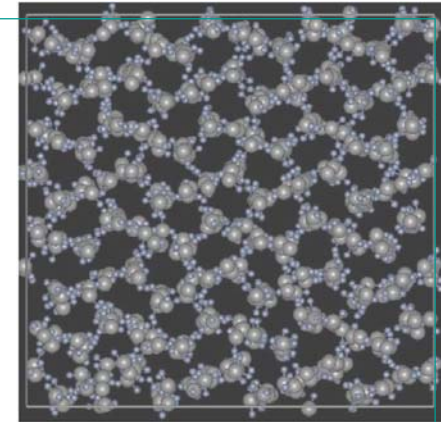
- Fluid dynamics and wave theory
 - Fully dispersive Boussinesq, apparent dispersion, nonlinear shallow water, time-reversed acoustics
- Environmental modelling
 - GEOMA: Climate modelling of the Amazon region
- Porous media
 - Petroleum reservoir flow
 - Transport of substances across groundwater
- Inverse problems in biophysical sciences
 - Optical diffusion tomography
 - 3D electron microscopy of macromolecules

People: Andre Nachbin, Marcus Sarkis, Jorge Zubelli.



Universidad Nacional Autónoma de México (UNAM)

- Global optimization methods
 - Tunneling methods
 - Evolutionary algorithms
- Inverse parameter estimation problems
 - Oil reservoir characterization, aquifers
- Thermodynamics and physical chemistry
 - Gibbs potential of ice, ice polymorphs, phase transitions
 - Minimal subcoideals and multiparameter deformations
- Mathematical modelling of Earth systems
 - Groundwater flow in fractured porous media

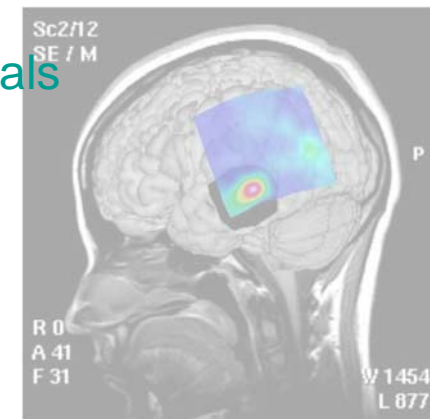
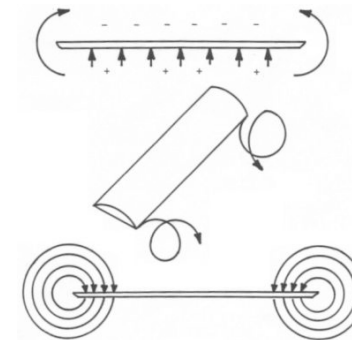


People: Susana Gomez, Ismael Herrera, Suemi Rodriguez, Vladimir Tchijov.



Universidad Santa María (USM)

- Fluid dynamics and Aerodynamics
 - Vortex sheet dynamics
 - Flows with surface tension
 - Lifting line theory, extended for shaped wings
- Elasticity
- Wavelet analysis and images
 - Image registration based on wavelet analysis
 - Representation of electroencephalographic signals
- Scientific computing and function theory



People: Oscar Orellana, Luis Salinas.