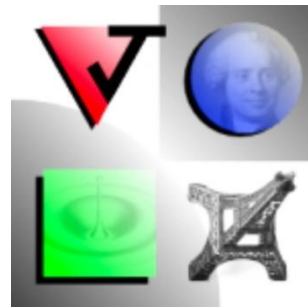


# Jean le Rond d'Alembert Institute

Mechanics, Acoustics, Energetics

<http://www.dalembert.upmc.fr>

presented through images created by Institute members in 2012/2013



d'Alembert  
UMR 7190

100 staff in five teams, one third of them recently recruited :

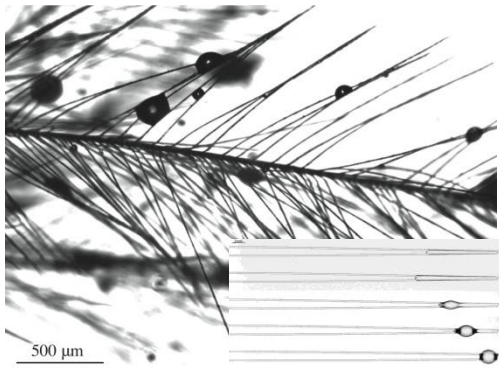
Complex Fluids and Hydrodynamic Instabilities FCIH

Reactive Fluids and Turbulence FRT

Lutheries, Acoustics, Music LAM

Modelling, Propagation and Acoustic Imaging MPIA

Mechanics and Engineering of Solids & Structures MISES

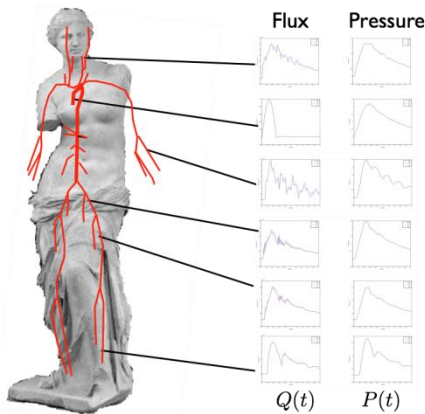


**Wetting of flexible fibres:**  
small scale fluid-structure interactions.

Deposition of a drop on an elastic fibre, spreading or not, depends on the drop size.

Why do feathers repel water? Understanding wettability.

Vénus of MOdeLisation



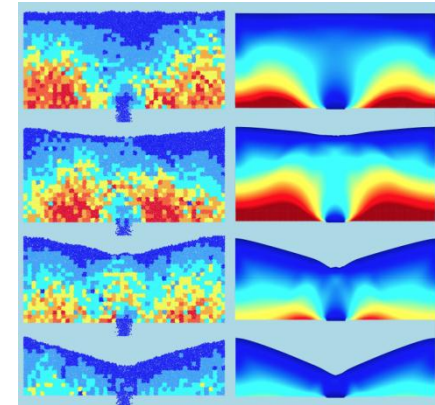
**Simulation of a human arterial network.**

Comparison of 1D numerical schemes.

Biomedical applications.



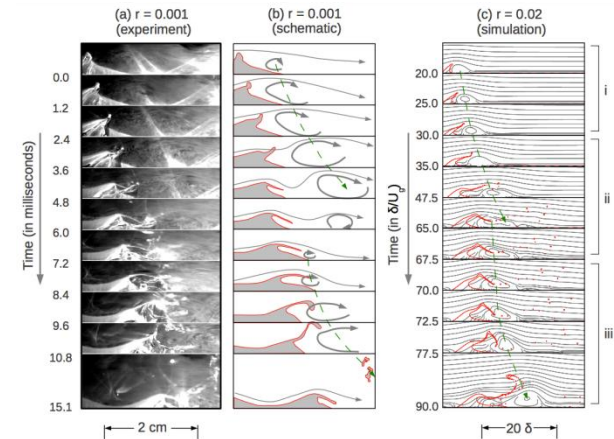
**Liquid jet in a large bubble.**  
High speed image.  
Universal scaling law for jet dynamics.



**Discharge of an hourglass.**

Discrete and continuous Gerris simulations.

Experimental Beverloo law is reobtained by simulations.

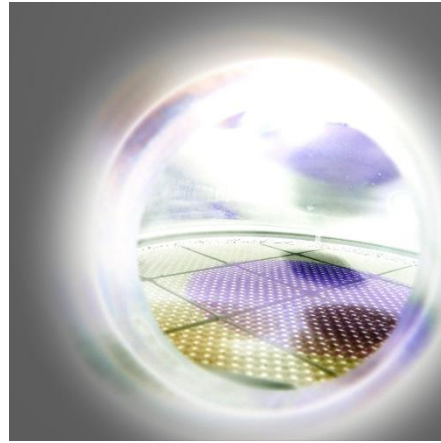


**Atomization of a liquid.**

LEGI experiments and Gerris numerical simulations.

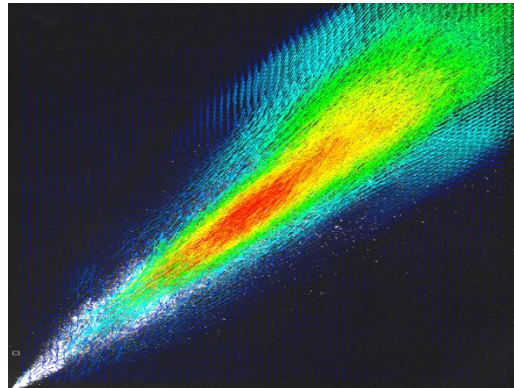
Vortices catapult droplets.

Multidisciplinary optimization of catalytic systems for exhaust pollution control.



Synthetic gas bench tests.

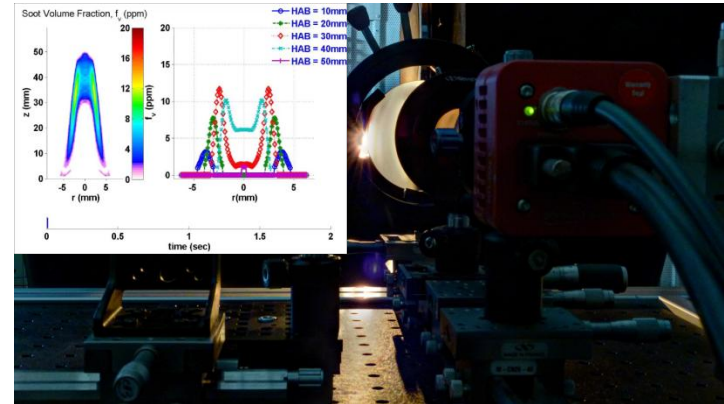
Mechanical and chemical ageing of catalysts after pollutant exposure.



High density spray of gasoline injector.

PIV measurement with advanced algorithms.

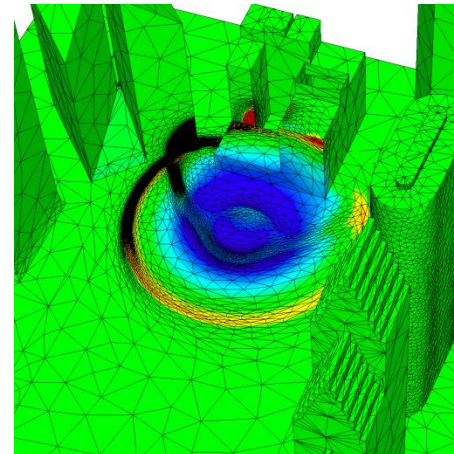
Understanding of cavitation and atomization process.



2D-Measurement of soot concentration issued from academic burner.

Light extinction measurement (LEM).

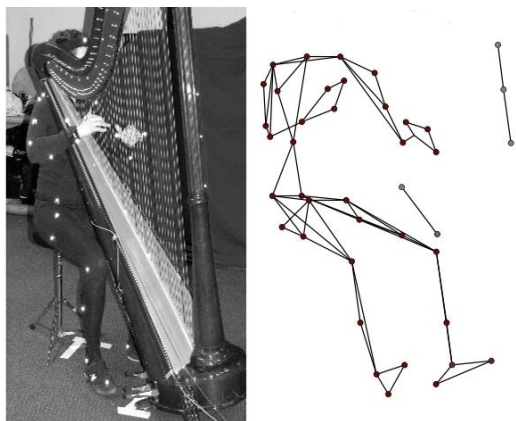
Conditions in space & time of soot release into atmosphere.



Shock waves propagation in a built environment.

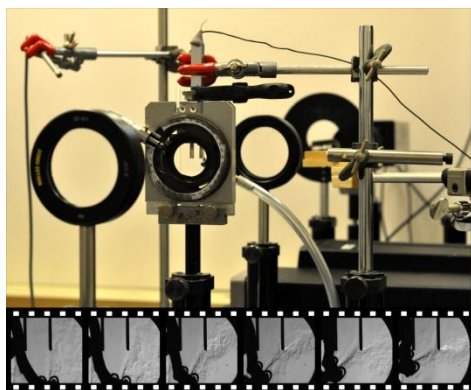
Goal-based anisotropic mesh adaptation method used for unsteady compressible flows. Adjoint-based adapted mesh for target functional (pressure deviation on the building on the left).





### Musician/instrument interaction.

Analysis of harpists' gestural strategies  
in playing situation  
(here by motion capture  
in coll. with CIRMMT (McGill University)).



### Aeroacoustic functioning of wind instruments.

Studying the input parameters  
of panpipes in turbulent regime.



### Preservation of sound recordings.

The long-term conservation of analog recordings goes through digitalisation,  
but the unreliable behavior of replacement carriers  
(optical or hard disks, flash memories...)  
represents a major risk of data loss that should be studied.

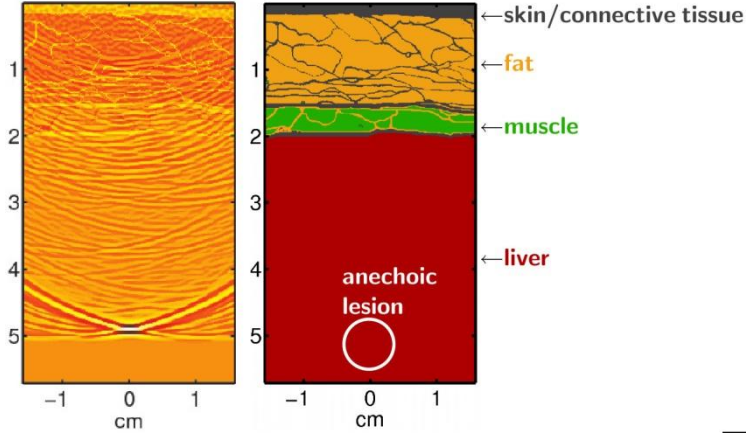
### Investigating perceptual differences between instruments.

Studying preferences  
(here among old Italian and new violins)  
of players and listeners  
by means of double blind tests.



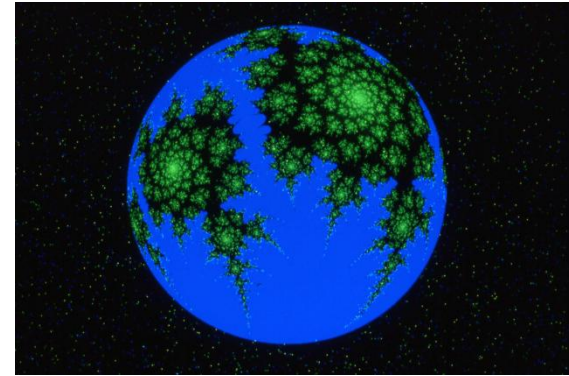
# MPIA : Modelling, Propagation and Acoustic Imaging

Mechanical waves, aeroacoustic, biomechanics, inverse problems, acoustic control/imaging



## Ultrasound propagation in the abdomen.

Non-linear acoustic wave equations simulated with finite differences.  
*In silico* ultrasound imaging based on propagation physics.



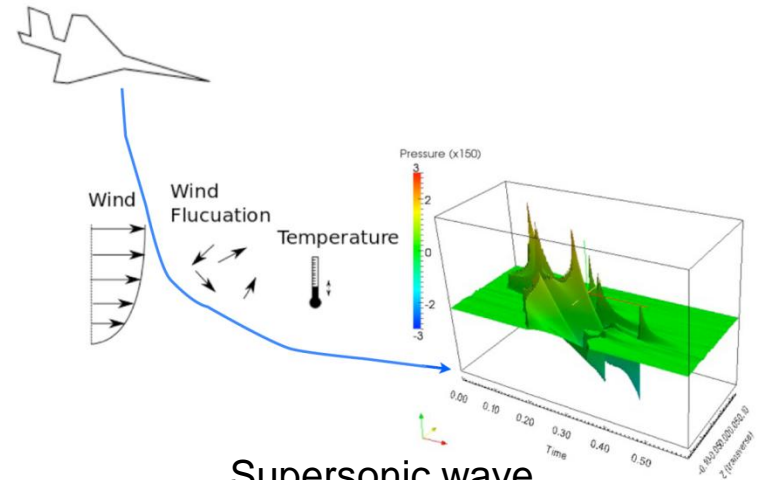
## Non-local fractional field theories of media with fractal (self-similar) interactions.

Analytical methods of generalized functions and distributions/integral transforms/fractional calculus.



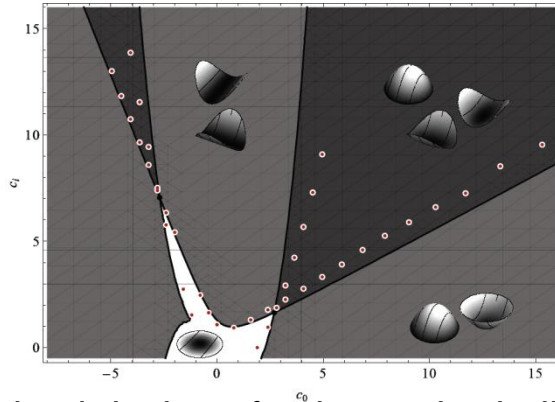
## Underwater acoustics.

Piezoceramic array engineering with radiators and receivers.  
Seabed identification.



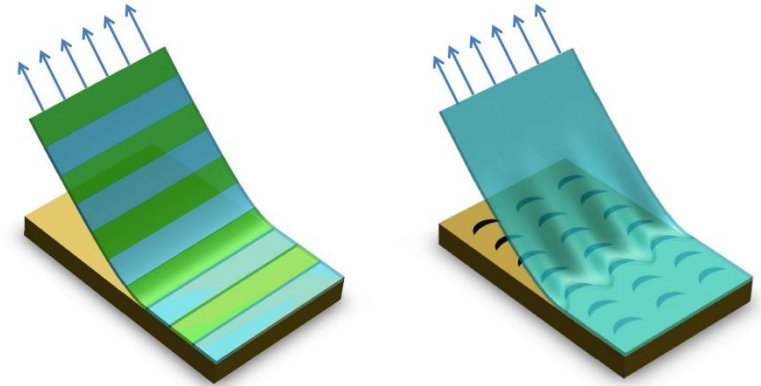
## Supersonic wave.

Analysis of the waveform deformation during propagation.  
Final waveform at the ground.



### Optimal design of anisotropic shells.

Variation of geometry, prestrains and anisotropy + simplified non-linear models based on Von Karman kinematics. Existence of regions with multiple stable equilibrium configurations



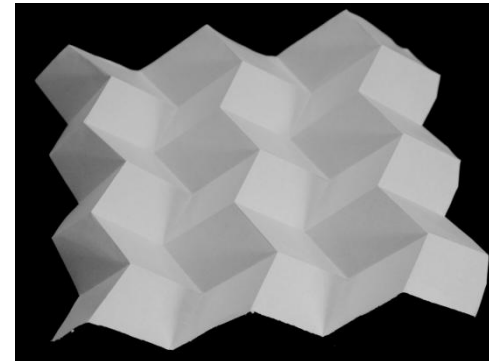
### Peeling of heterogeneous adhesives.

Combined experimental and theoretical investigation. Adhesion enhancement, crack propagation laws in heterogeneous media.



### Mechanical response of copper polycrystals (uniaxial load).

FFT-based modeling of the elastoplastic behavior of polycrystals. Influence of local anisotropy on stress concentration at grain boundaries.



### Miura-Ori type folding.

Buckling of thin films bound to a compliant substrate. Herringbone solutions at large buckling parameters.