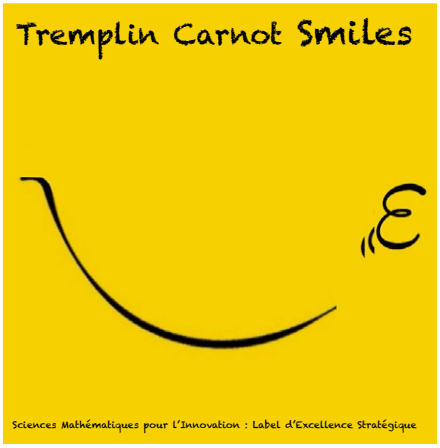
TREMPLIN CARNOT Smiles

www.carnot-smiles.fr

SMILES : Mathematical Sciences for Innovation, Label of Strategic Excellence

Sciences Mathématiques pour l'Innovation, Label d'Excellence Stratégique

The SMILES Associated Carnot is a public research institute which aims at making the most of the power of applied mathematics, through collaborative research, in order to foster innovation processes within private companies of all sectors. Made up of multi-disciplinary teams, the institute accompanies its industrial partners in their technological challenges with its skills in mathematical modeling and numerical simulation in: fluid and structure mechanics, acoustics, universe and life sciences, big data, chemistry, electronics, plasma physics, nanoscience...



Put the unreasonable efficiency of mathematics into action for the innovation within companies

Our main research topics :

Mathematical modeling

- Partial differential equations : flows (blood, respiratory, porous medium), growth and motion in cell populations, risk and finance, mass behaviour, plasma fusion...
- Random framework
- Model reduction
- Coupling phenomenon (structural, thermal, fluid, magnetism, electrical)
- Optimization and optimal control

Numerical simulation

- Conception and optimization of algorithms: embedded systems, cloud computing, precision level, in an existing chain or to be created...
- Parallel computing algorithmic, real time simulation
- HPC, high dimension computing, parallelism in time
- Computing clusters: CPU/GPU, shared/distributed memory

Data science for the Big Data

- Neural networks, machine learning, deep learning
- Statistical analysis, classification, data mining

Complex and multiphase fluids modeling

- Atomization, bubble dynamics, droplet impacts
- Elasto-capillarity: micro-fluidic, drop / thin rod interaction, drop / soft substratum interaction
- Granular and viscous-plastic flows, turbulent flows modeling (RANS, statistical, LES)
- Hydrodynamic stability (waves, vortex)

Acoustics

- Aeroacoustics
- Acoustic propagation and diffusion in medium which are: heterogeneous, multi-layers, with differences in properties
- Shockwave propagation
- Acoustic imaging

Mechanics

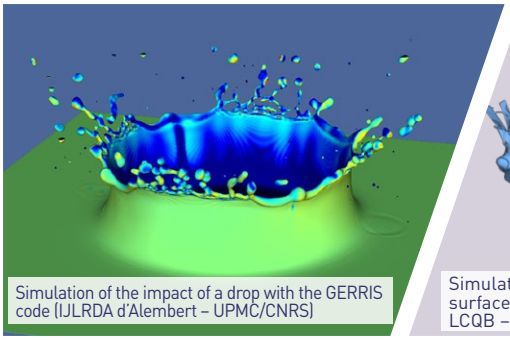
- Damaging mechanics
- Heterogeneous materials, micro-mechanics
- Rupture mechanics : fragile, ductile, initiation
- Meta-materials : mechanical, acoustic, adhésive

Computational and quantitative biology

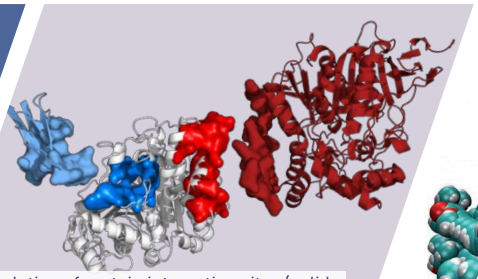
- Analytical genomics, meta-genomics
- Functional analysis of the microbial community
- Protein-protein interaction, cellular interaction
- Protein conformational dynamics

Quantum and theoretical chemistry

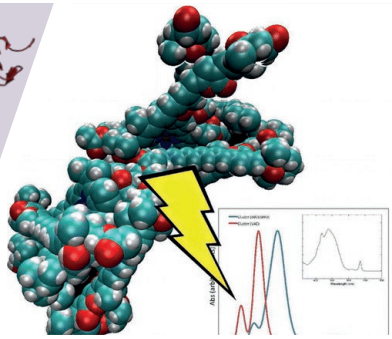
- Dynamical molecular simulations, catalysis modeling, forces between molecules
- Chemistry of the extreme medium in gaseous or condensed phase
- Multi-scale simulation methods



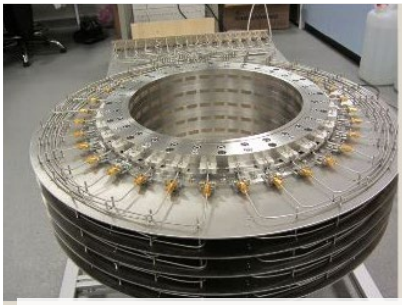
Simulation of the impact of a drop with the GERRIS code (IJLRDA d'Alembert – UPMC/CNRS)

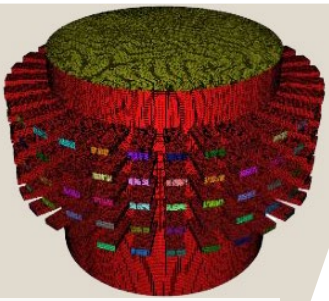


Simulation of protein interaction sites (solid surfaces) predicted by JET2 tools (laboratory LCQB – UPMC/CNRS)

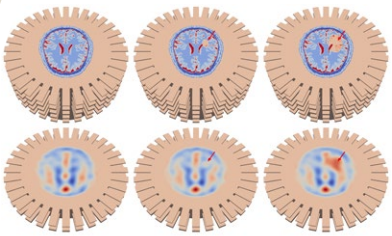


Quantum computation for large (or very large) molecules: a new approach of linear complexity in QM / continuous coupling (laboratory LCT – UPMC/CNRS)





Microwave imaging of a quasi-instantaneous CVA with the code freeFEM ++: mesh at 2.3 M degrees of freedom, domain decomposition and parallel computation in 5 minutes on 64 cores (laboratory LJLL – UPMC/Paris 7/CNRS)



Markets

- Aeronautics
- Insurance
- Car
- Chemistry
- Energy
- Environment
- Rail
- Finance
- Materials
- Pharmaceutical
- Networks and telecoms
- Spatial
- Health and e-health

Our commitments

- One single office to make a contract: simplify the initial contact and accelerate the contractualization process
- Quality of the contractualization: a team of business officers and legal experts build and maintain the interface between researchers and companies for setting up the research partnerships contracts

The SMILES Associated Carnot environment

- MeSU-alpha : a 1024-core cluster with a 16 To shared memory
- MeSU-beta : a 2020-core cluster with shared memory
- Labex Calsimlab
- Labex Plas@Par
- Labex Fondation de Sciences Mathématiques de Paris
- Equipex Equip@meso

An IP policy well defined

- Shared ownership of the results of the research partnership (but transfer is possible)
- Exclusivity of explotation of the results in the identified domain for the industrial partner

Research staff (full-time equivalent): **304**

including PhD students: **148**

Partnership income with industry: **1,6 M€**

Global budget: **18,5 M€**

CONTACT

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Le réseau des INSTITUTS CARNOT

www.instituts-carnot.eu