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LPTM

Theoretical Physics and Modeling Laboratory

LPTM
laboratoire de physique théorique et modélisation

UMR CNRS 8089
21 teacher-researchers-ITAR, 29 doctoral and postdoctoral researchers

The LPTM research focuses on theoretical physics, particularly statistical physics of large systems at low energy scales, using mathematical and numerical methods. Key areas include condensed matter, nonlinear, integrable, complex, biological, and active systems, with an emphasis on nonequilibrium phenomena, phase transitions, stochastic processes, and quantum measurements. Research is organized into three themes: Condensed Matter & Quantum Phenomena; Integrability, Dynamics & Stochasticity; and Soft Matter, Active matter, Complex Systems & Neurosciences. The LPTM also engages in teaching and mentoring at all levels at the University of Cergy-Pontoise.

KEYWORDS SCIENCE

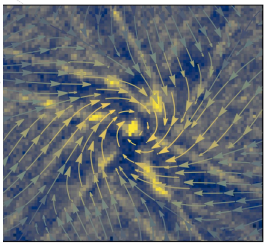
Statistical Physics
Nonlinear Dynamics
Quantum Systems
Out-of-Equilibrium Physics
Disordered Systems
Integrable Models
Quantum Technologies
Mathematical Modeling
Computational Physics
Condensed Matter
Active Matter
Networks Dynamics

KEYWORDS APPLICATIONS

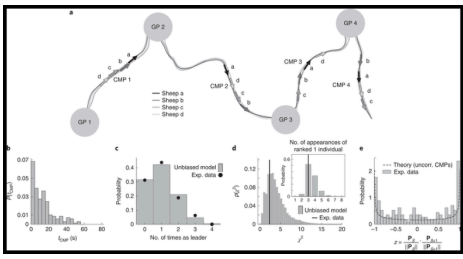
Quantum Computing
Material Science
Energy Systems
Complex Systems Modeling
Biological Systems
Economic Modeling
Surface Physics
Nanotechnology
Thin Film Technology
Quantum Information

APPLICATIONS AND INDUSTRIAL SECTORS

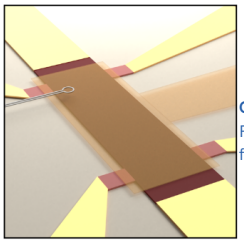
- Quantum computing and quantum information processing
- Advanced materials for electronics and energy
- Modeling of complex systems in physics, economics, and biology
- Nonlinear dynamics for energy and environmental systems
- Thin film and surface technologies
- Quantum Technologies
- Energy and Sustainability
- Materials Science and Nanotechnology
- Data Science and Complex Systems
- Semiconductors and Electronics



Giant Atomic Swirl in Graphene Bilayers with Biaxial Heterostrain
Trambly de Laissardière et al. (Advanced Materials, 2023) reveal a "giant atomic swirl" in bilayer graphene from biaxial heterostrain.



Sheep Leadership and Collective Motion
Figure 1: Sheep randomly alternate leadership, balancing hierarchical and democratic behavior (Nature Physics, 2022).



Chern Insulator Setup
Fig. 1: Chern insulator with electrodes and SQUID magnetometer for measuring magnetic fields and current distribution (Nat. Mater., 2023).

KNOW-HOW · SKILLS · EXPERTISE · SPECIFIC FEATURES

- Theoretical and Computational Physics: Advanced modeling techniques and simulations.
- Quantum Technologies: Research on quantum systems and out-of-equilibrium phenomena.
- Study of disordered materials, integrable models, and chaos theory.
- Complex Systems

RESEARCHS PARTNERSHIPS

- DIM SIRTEQ and associate to Labex MME-DII
- Paris center for quantum technologies
- Complex systems society

PUBLICATIONS :

- Jouda Jemaa Khabthani, Khouloud Chika, Ghassen Jemaï, Didier Mayou, Guy Trambly de Laissardière. Electronic structure and conductivity in functionalized multilayer black phosphorene. Physical Review B, 2024, 110 (4), pp.045150. ⟨10.1103/physrevb.110.045150⟩. ⟨hal-04669374⟩
- Matteo Lodi, Shirin Panahi, Francesco Sorrentino, Alessandro Torcini, Marco Storace. Patterns of synchronized clusters in adaptive networks. Communications Physics, 2024, 7, pp.198. ⟨10.1038/s42005-024-01688-5⟩. ⟨cea-04632788⟩
- Alexios Christopoulos, Pierre Le Doussal, Denis Bernard, Andrea de Luca. Universal out-of-equilibrium dynamics of 1D critical quantum systems perturbed by noise coupled to energy. Physical Review X, 2023, 13 (1), pp.011043. ⟨10.1103/PhysRevX.13.011043⟩. ⟨hal-04245132⟩

For additional publications, please scan here.

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