Daniel Yaacoub

04/11/1998, Marseille, France
danyaacoub@gmail.com
daniel.yaacoub@doctorant.uca.fr
https://www.danielyaacoub-physique.fr
+33(0) 6 51 70 17 71

EDUCATION

2021 - now   **PhD candidate** at Clermont-Auvergne Université

Branching Stochastic Processes for path-integral representation of photosynthetic charges drift-diffusion *under the supervision of* Pr. J.-F. Cornet (Institut Pascal, Clermont-Auvergne University) *and* Pr. R. Fournier (LAPLACE, Toulouse-III University).

- Theoretical modeling of photosynthetic primary steps and thermokinetic couplings. Extension of path-space Feynman-Kac's framework to address propagative representations of non-linearly coupled drift-diffusion models by use of Branching Stochastic Processes. Construction of statistical estimators providing Monte Carlo numerical implementations in both confined spaces and complex geometries.

2020 - 2021   **M2 Fundamental physics (international theoretical physics training) [2/24, *highest honours*]** at Aix-Marseille Université

Equilibrium and Non-equilibrium statistical physics (CPT) :

- Advanced classical statistical physics / Stochastic processes and fluctuations : Path-space topological formulation of Hamiltonian chaos. Stochastic equations, fluctuations, dissipations and Markov processes.

- Advanced quantum statistical physics near equilibrium : Quantum Field Theory, Paths-integrals formulations and Renormalization methods within the framework of quantum transport (BCS superconductivity, Green-Kubo methods, Luttinger liquids).

Non-linear physics and Dynamical systems (IRPHÉ) :

Instabilities and road to chaos. Self-organization, multiscale analysis and patterns formation.

Out of equilibrium physics and Complex systems (CENTURI) :

- Complex networks and network-based dynamical processes. Physics of living systems and soft matter (Self-organized patterns and feedback models. Neural networks and learning dynamics theories. Collective behaviors and emergence of cellular/molecular motion out of equilibrium).

2019 - 2020   **M1 Fundamental physics** at Aix-Marseille Université

2018 - 2019   **L3 Fundamental physics [1/56, *highest honours*]** at Toulouse-III Université

2016 - 2018   **CUPGE - Preparatory classes** at Toulouse-III Université

DIPLOMA

2021	**M.Sc. - Fundamental physics** at Aix-Marseille Université	
	high honours	
2019	**B.Sc. - Fundamental physics** at Toulouse-III Uniiversité	
	highest honour	
2016	**Baccalaureat Sc-Physics** at Lycée Notre Dame de Sion	
	highest honour	
2016	**Musical Studies Brevet** at Conservatoire de Marseille	
	high honours	

ATTENDED SCHOOLS AND SEMINARS

2021   **TAMARYS, national GDR annual days** (Bordeaux, 3 days)

Multi-scale and multi-physics approaches to thermal transfer and non-linear coupling

2022   **ZIRCON, annual interregional conference** (Clermont-Ferrand, 3 days)

Transfer Evolution Formalism for model partitioning, coupling and feedback analysis in non-linear systems

2021/22/23/24 **EDSTAR consortium annual workshop** (Saint Front, 4×5 days)

Statistical approaches to transport and multi-scale/multi-physics Monte Carlo methods
under the leadership of LAPLACE and RAPSODEE.

TALKS AND ORAL COMMUNICATIONS

2024   **STARDIS consortium, national congress** (Toulouse, 2 days)

Path-Space coupling to drift velocity models : Probabilistic representation and statistical sampling [30 min].

2024   **MCMET (ANR), anual days** (Toulouse, 3 days)

Field coupling to velocity models [20 min].

2023   **STARDIS consortium, national congress** (Toulouse, 2 days)

Monte Carlo gradient estimations in complex geometries [15 min].

2023   **FédEsol consortium, national congress** (Clermont-Ferrand, 2 days)

Thermokinetic coupling : 0d vs 3d, linear vs non-linear [15 min].

2023   **LMBP Phd seminar** (Clermont-Ferrand)

Path-space physics and statistical approaches to PDEs : Feynman-Kac and Monte Carlo [30 min] Laboratoire de MAthématiques Blaise Pascal.

2022   **TAMARYS consortium, national congress** (Lyon, 3 days)

Photogeneration, transfer and conversion of electronic energy in paths-space for solar processes inverse design. [15 min] LAPLACE, Institut Pascal, LEMTA, IES, EDStar collaboration.

PUBLICATIONS AS A CO-AUTHOR

2024   **Solar Hydrogen Production by Artificial Photosynthesis in Photoreactor for Sustainable Mobility**

G. Foin, J.-F. Cornet, F. Gros, *[...]*, D. Yaacoub, DOI: 10.52825/solarpaces.v1i.653, [2024].

2022   **Advection, diffusion and linear transport in a single path-sampling Monte-Carlo algorithm : getting insensitive to geometrical refinement**

L. Ibarrart, S. Blanco, C. Caliot, J. Dauchet, *[...]*, D. Yaacoub, hal-03818899v2, [2022].

2022   **Coupling radiative, conductive and convective heat-transfers in a single Monte Carlo algorithm: a general theoretical framework for linear situations**

J.-M. Tregan, J.-L. Amestoy, M. Bati, S. Blanco, *[...]*, D. Yaacoub, hal-03819157, **Plos One**, [2022].

TEACHING ACTIVITIES [130H]

2021-2024   **INP teaching assistant** at SIGMA engineering school, Clermont-Ferrand

Out-of-equilibrium phenomena and balances (Bachelor last year level [L3]) [**42h**, *tutorials*]
Mass/heat transfer and chemical reactions. Energy/matter balances toward processes dimensionalization.

2022-2024   **INP teaching assistant** at SIGMA engineering school, Clermont-Ferrand

Equilibrium thermodynamics and balances (Bachelor last year level [L3]) [**28h**, *tutorials*]
Principles and applications of equilibrium-state thermodynamics. Matter and energy balances.

2022-2024   **UCA teaching assistant** for Life Sciences bachelor, Clermont-Ferrand

Radioactivity (Bachelor first year level [L1]) [**24h**, *lectures/tutorials*]
Introduction to radioactivity basics for Life Sciences first year students. Principles and exponential law.

2022-2024   **UCA teaching assistant** for Life Sciences bachelor, Clermont-Ferrand

Electrostatics (Bachelor first year level [L1]) [**36h**, *tutorials*]
Dipolar momentum, polarization of molecules. Dipolar electric field. Screening effect.

RESEARCH EXPERIENCES

2021   **M2 Research internship (5 months)** at LIPHY, Grenoble

Stationary states and correlations in active matter models *under the supervision of Dr. V. Lecomte*

In the framework of active interacting overdamped particles subject to a noisy self-propulsion velocity, a generic procedure allowing us to compute analytically the perturbative expansion of the probability distribution in a limit of weak activity (*i.e.* weak temporal correlations of the noise) is build. Motivated by the concordance between our results and the pre-existing ones derived by paths integrals methods, we develop a controlled extension of the weak activity regime based on Pade-Borel-Laplace resummation procedure for divergent series, in view of reaching the strong activity limit and understanding the expected undergoing phase transition. In the weak activity regime, we attend to construct a well controlled procedure to the case of a 2d active Ornstein-Uhlenbeck process.The ensuring analytical results allow us to predict new phenomena due to the existing non-local correction of the stationary probability in the presence of activity : [1] a trapping effect, [2] a ratchet effect and [3] a rotational effect. The laters are cross-checked with stochastic numerical simulations. See report here.

2021   **M2 Research project** at CPT, Marseille

Microcanonical Monte Carlo simulation of a glass forming binary mixture to characterise the geometry of energy surfaces *[Pr. M. Pettini]*

2020   **M1 Research internship (2 months)** at IRPHÉ, Marseille

Mixed convective/diffusive layers in spherical shells configurations *[Dr. M. Le Bars]*

2019   **L3 Research internship (2 months)** at LAPLACE, Toulouse

Microwave electromechanical conversion *[Pr. O. Pascal]*

COLLECTIVE RESPONSIBILITIES AND SEMINARS ORGANIZATION

- GePEB - Institut Pascal PhD's representative.
- Creation and organization of GePEB PhD's seminars, workshops and website.

LANGUAGES

Programming Languages

MATHEMATICA, LATEX, PYTHON, C++

Languages

Native tongue   French
B2   English

ASSOCIATIVE COMMITMENTS, INTERESTS AND HOBBIES

- Organ player at Clermont-Ferrand's Cathedral.
  Member of "*Association des amis des orgues de Notre Dame de Clermont*"
- Organ player at Marseille.
  Member of "*Association des amis des orgues de Ste Marguerite*"
- Improvisation and interpretation (pipe organ, piano).
- Epistemology, phenomenology, poetry.