ALAIN BLAUSTEIN

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RESEARCH EXPERIENCE

Postdoctoral Scholar/Research Assistant *September 2023 - present*
Department of Mathematics, Pennsylvania State University, USA

Ph.D. program with Prof. Francis Filbet *September 2020 - September 2023*
Institut de Mathématiques de Toulouse, France

Subject : "Theoretical and numerical analysis of mean-field models arising in Physics and Biology".
Defense date: 26/06/2023

Internship with Prof. Francis Filbet *April-July 2020*
Institut de Mathématiques de Toulouse, France

Subject : "Mean-field limit for a spatially extended FitzHugh-Nagumo neural network".

Master thesis with Prof. Roger Lewandowski *November 2018-January 2019*
Université Rennes 1, France

Subject : "Well posedness of the incompressible Navier-Stokes equations on short times".

Internship with Prof. Guillaume Bal *April - June 2018*
University of Chicago, USA

Subject : "Stochastic Homogenization of the Poisson equation with degenerated diffusion coefficients".

Internship with M.d.C. Pierre Dehornoy *May - June 2017*
Institut Fourier, Grenoble, France

Subject : "Birkhoff sections of the geodesic flow in the torus".

EDUCATION AND DEGREES

Graduated the French Agregation *September 2018 - June 2019*
École Normale Supérieure, Rennes, France

Major : "Scientific Computing".

BSc and MSc in Fundamental Mathematics *September 2016 - June 2020*
École Normale Supérieure, Rennes, France

Graduated with high Honors.

Post-Secondary prepatory classes *September 2014 - June 2016*
Lycée Charlemagne, Paris, France

University-level courses required in preparation for competitive entrance exams into top engineering and graduate schools (France's "Grandes Écoles").

RESEARCH INTERESTS

My research interests lie in the **asymptotic** and **numerical analysis** of **partial differential equations** for interacting agents in models with application in **kinetic theory** and **neuroscience**.
I focus on establishing links between the multiple scales inherent to these systems. Specifically, I have worked on longtime behaviors and hydrodynamic limits of these systems. I aimed, on the one hand, at proving theoretical results quantitatively bridging these regimes and, on the other hand, at designing numerical methods which preserve these connections.

LIST OF PUBLICATIONS

(1) **Concentration phenomena in FitzHugh-Nagumo's equations: a mesoscopic approach** *2023*
SIAM J. Math. Anal. 55 (2023), no. 1, p. 367-404, with F. Filbet.

(2) **On a discrete framework of hypocoercivity for kinetic equations** *2024*
AMS Math. Comp. 93 (2024), no. 345, p. 163-202, with F. Filbet.

(3) **Diffusive limit of the Vlasov-Poisson-Fokker-Planck model: quantitative and strong convergence results** *2023*
SIAM J. Math. Anal. 55 (2023), no. 5, p. 5464-5482.

(4) **Large coupling in a FitzHugh-Nagumo neural network: quantitative and strong convergence results** *2023*
J. Differential Equations 374 (2023), 218–266.

(5) **Concentration profiles in FitzHugh-Nagumo neural networks: A Hopf-Cole approach** *2023*
to appear in Discrete and Continuous Dynamical Systems Series B, with E. Bouin.

(6) **A structure and asymptotic preserving scheme for the Vlasov-Poisson-Fokker-Planck model** *2023*
to appear in the Journal of Computational Physics, with F. Filbet.

INVITATIONS TO WORKSHOP AND CONFERENCES

Webinar of the French-Korean IRL in Mathematics *06/2023*
Happening virtually.

PDE seminar *03/2023*
IRMAR, Rennes, France.

SIAM Conference on Computational Science and Engineering *03/2023*
RAI Congress Centre, Netherland.

Seminario de Ecuaciones Diferenciales *02/2023*
Universidad de Granada, Spain.

RSME 2023 LEON *02/2023*
Universidad de Leon, Spain.

Kinetic and hyperbolic equations analysis, modeling and numerics *12/2022*
Insitut de Mathématiques de Toulouse, France.

2022 International Conference on Mathematical Neuroscience *07/2022*
Happening virtually.

Workshop ANR ChaMaNe *06/2022*
Île Rousse, France.

Frontiers in kinetic theory: connecting microscopic to macroscopic scales *05/2022*
Isaac Newton Institute, Cambridge, UK.

SIAM 2022 Conference on Analysis of Partial Differential Equations *03/2022*
Happening Virtually.

Asymptotic Behaviors of systems of PDEs arising in physics and biology *11/2020*
Polytech Lille, Villeneuve-d'Ascq, France.

Models and Methods for kinetic equations *10/2020*
Institut de Mathématiques de Bordeaux, Talence, France.

ORGANIZING RESPONSABILITIES

Co-organizer of the PDE doctoral seminar *09/2022 - Present*
Institut de Mathématiques de Toulouse.

PROGRAMMING SKILLS

C++, Python, Matlab, Caml, Latex

TEACHING

Pennsylvania State University. *2023 - 2024*
*4 unit course (49*1.5 $\sim$ 73h eq. TD), calculus, first year of BSc.*
Université Paul Sabatier. *2022 - 2023*
4h of pratictal works (Python), linear algebra, first year of BSc.

30h of tutorials, mathematics, first year of BSc.

Université Paul Sabatier. *2021 - 2022*

26h of lecture and tutorials, linear algebra, first year of BSc.
9h of pratictal works (Python), linear algebra, first year of BSc.
30h of tutorials, mathematics, first year of BSc.

Université Paul Sabatier. *2020 - 2021*

26h of lecture and tutorials, linear algebra, first year of BSc.
30h of tutorials, mathematics, first year of BSc.

SKILLS

Language French (Native speaker), English (fluent)