

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
Lycée Charlemagne, Paris, France

September 2014 - June 2016

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.

LIST OF PRE-PRINTS

- (1) **Derivation of the bacterial run-and-tumble kinetic model : quantitative and strong convergence results** 2023

INVITATIONS TO WORKSHOP AND CONFERENCES

Workshop on stability analysis for nonlinear PDEs <i>PSU Math dept. , State College, USA.</i>	<i>10/2023</i>
Webinar of the French-Korean IRL in Mathematics <i>Happening virtually.</i>	<i>06/2023</i>
PDE seminar <i>IRMAR, Rennes, France.</i>	<i>03/2023</i>
SIAM Conference on Computational Science and Engineering <i>RAI Congress Centre, Netherland.</i>	<i>03/2023</i>
Seminario de Ecuaciones Diferenciales <i>Universidad de Granada, Spain.</i>	<i>02/2023</i>
RSME 2023 LEON <i>Universidad de Leon, Spain.</i>	<i>02/2023</i>
Kinetic and hyperbolic equations analysis, modeling and numerics <i>Institut de Mathématiques de Toulouse, France.</i>	<i>12/2022</i>
2022 International Conference on Mathematical Neuroscience <i>Happening virtually.</i>	<i>07/2022</i>
Workshop ANR ChaMaNe <i>Île Rousse, France.</i>	<i>06/2022</i>
Frontiers in kinetic theory: connecting microscopic to macroscopic scales <i>Isaac Newton Institute, Cambridge, UK.</i>	<i>05/2022</i>
SIAM 2022 Conference on Analysis of Partial Differential Equations <i>Happening Virtually.</i>	<i>03/2022</i>
Asymptotic Behaviors of systems of PDEs arising in physics and biology <i>Polytech Lille, Villeneuve-d'Ascq, France.</i>	<i>11/2020</i>
Models and Methods for kinetic equations <i>Institut de Mathématiques de Bordeaux, Talence, France.</i>	<i>10/2020</i>

ORGANIZING RESPONSABILITIES

Co-organizer of the PDE doctoral seminar <i>Institut de Mathématiques de Toulouse.</i>	<i>09/2022 - Present</i>
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PROGRAMMING SKILLS

C++, Python, Matlab, Caml, Latex

TEACHING

Pennsylvania State University. <i>4 unit course (49*1.5 ~ 73h eq. TD), calculus, first year of BSc.</i>	<i>2023 - 2024</i>
Université Paul Sabatier. <i>4h of practical works (Python), linear algebra, first year of BSc.</i> <i>30h of tutorials, mathematics, first year of BSc.</i>	<i>2022 - 2023</i>
Université Paul Sabatier. <i>26h of lecture and tutorials, linear algebra, first year of BSc.</i> <i>9h of practical works (Python), linear algebra, first year of BSc.</i> <i>30h of tutorials, mathematics, first year of BSc.</i>	<i>2021 - 2022</i>
Université Paul Sabatier. <i>26h of lecture and tutorials, linear algebra, first year of BSc.</i> <i>30h of tutorials, mathematics, first year of BSc.</i>	<i>2020 - 2021</i>

SKILLS

Language	French (Native speaker), English (fluent)
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