# 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.*

## LIST OF PRE-PRINTS

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

## INVITATIONS TO WORKSHOP AND CONFERENCES

**Workshop on stability analysis for nonlinear PDEs** *10/2023*
*PSU Math dept. , State College, USA.*

**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 ∼ 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)