Simon Michaël Schulz

PERSONAL DETAILS

DoB	[redacted]
Citizenship	French, British
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EMPLOYMENT

Junior Visiting Position 2023-
Centro di Ricerca Matematica Ennio De Giorgi, Scuola Normale Superiore

Van Vleck Assistant Professor 2021-2023
Department of Mathematics, University of Wisconsin-Madison

Postdoctoral Research Associate 2019-2021
Faculty of Mathematics, University of Cambridge
Supervisor: Dr Maria Bruna

EDUCATION

DPhil. Mathematics 2015-2019
University of Oxford
Supervisor: Prof. Gui-Qiang Chen
Thesis: Compensated compactness methods in the study of compressible fluid flow
Examiners: Prof. Endre Süli and Prof. Denis Serre
Funded by EPSRC Centre for Doctoral Training in Partial Differential Equations

MASt. Mathematics (Part III) 2014-2015
University of Cambridge
Specializing in Analysis & Partial Differential Equations
Funded by St John's College Benefactors' Scholarship

MEng. Information Engineering 2013-2014
University of Cambridge
Specializing in Control & Signal Processing

BA. Hons 2010-2013
University of Cambridge
Mixed cursus in mathematics and engineering.

PUBLICATIONS

15. **Isentropic Euler equations with with general pressure law for $\gamma > 3$**, *with G.-Q. Chen and M. R. I. Schrecker*, in preparation.

14. **Regularity for a model of active crowds with nonlocal and degenerate diffusions**, *with L. Alasio*, in preparation.

13. **One-Dimensional Carrollian Fluids III: Global Existence and Weak Continuity in L^∞**, *with M. Petropoulos and G. Taujanskas*, `arXiv:2407.05972`.

12. **One-Dimensional Carrollian Fluids II: C^1 Blow-Up Criteria**, *with N. Athanasiou, M. Petropoulos, and G. Taujanskas*, `arXiv:2407.05971`.

11. **One-dimensional Carrollian fluids I: Carroll–Galilei duality**, *with N. Athanasiou, M. Petropoulos, and G. Taujanskas*, `arXiv:2407.05962`.

10. **Regularity and trend to equilibrium for a non-local advection-diffusion model of active particles**, *with L. Alasio and J. Guerand*, submitted, `arXiv:2403.09282`.

9. **The Morawetz problem for supersonic flow with cavitation**, *with G.-Q. Chen and T. P. Giron*, submitted, `arXiv:2401.17524`.

8. **Well-posedness and stationary states for a crowded active Brownian system with size-exclusion**, *with M. Burger*, submitted, `arXiv:2309.17326`.

7. **Well-posedness of an integro-differential model for active Brownian particles**, *with M. Bruna, M. Burger, and A. Esposito*, SIAM J. Math. Anal. **54** (2022) 5662–5697.

6. **Phase separation in systems of interacting active Brownian particles**, *with M. Bruna, M. Burger, and A. Esposito*, SIAM J. Appl. Math. **82** (2022) 1635–1660.

5. **Existence and regularity for a system of porous medium equations with nonlocal drift and small cross-diffusion**, *with L. Alasio, M. Bruna, and S. Fagioli*, Nonlinear Analysis **223** (2022) 113064.

4. **On Liouville-type theorems for the 2D stationary MHD equations**, *with N. De Nitti and F. Hounkpe*, Nonlinearity **35** (2022) 870–888.

3. **Inviscid limit of the compressible Navier–Stokes equations for asymptotically isothermal gases**, *with M.R.I. Schrecker*, J. Differential Equations **269** (2020) 8640–8685 [**Corrigendum** in **287** (2021) 78–87].

2. **Vanishing viscosity limit of the compressible Navier–Stokes equations with general pressure law**, *with M.R.I. Schrecker*, SIAM J. Math. Anal. **51** (2019) 2168–2205.

1. **Liouville type theorem for the stationary equations of magneto-hydro dynamics**, Acta Math. Sci. **39** (2018) 491–497.

SEMINAR RESPONSIBILITIES

3. Co-organizer of the Geometric Analysis and PDE Seminar (University of Cambridge, LT 2020).
2. Organizer of the Nonlinear PDE Seminar (University of Oxford, 2018-2019).
1. Co-organizer of the OxPDE Student Seminar (University of Oxford, 2017-2018).

TALKS

16. National PDE Network Workshop on Discontinuities and Singularities of Solutions to Nonlinear Evolution PDEs (October 2024, Oxford, UK).
15. EPFL Analysis Seminar (June 2024, Lausanne, Switzerland).
14. Workshop on Particle Systems in Dynamics, Optimization, and Learning (March 2024, Paris, France).
13. PDE Seminar University of Cambridge (February 2024, Cambridge, UK).
12. SPASS Seminar Università di Pisa (October 2023, Pisa, Italy).
11. Séminaire EDP de l'Institut Camille Jordan, Université Lyon I (July 2023, Lyon, France).
10. Workshop on Nonlinear PDEs: Analysis and Applications, University of Pittsburgh (April 2023, Pittsburgh, PA, USA).
9. John's Hopkins University Analysis & PDE Seminar (online, February 2022, Baltimore, MD, USA).
8. UW-Madison PDE Seminar (September 2021, Madison, WI, USA).
7. Purdue PDE Seminar (online, May 2021, Lafayette, IN, USA).
6. Joint ICL/UCL Pure Analysis and PDEs Seminar (online, March 2021 London, UK).
5. Geometric inequalities & recent topics in nonlinear PDEs (February 2021, Online).
4. PDE Lunchtime Seminar (January 2020, Oxford, UK).
3. EMS School in Applied Mathematics, Mathematical Aspects of Fluid Flows (May 2019, Kácov, Czech Republic).
2. Joint CDT Conference, Analysis and PDE (April 2018, Oxford, UK).
1. Chinese Academy of Sciences, PDE Seminar (September 2017, Beijing, China).

GRADUATE SUPERVISION

2. (2021) Thomas Gamet, *École Normale Supérieure de Lyon Stage M1 Mathématiques*: “Unicité des solutions à valeur dans les mesures”.
1. (2021) Oscar de Wit, *Cambridge Part III Mathematics Essay*: “The Aubin–Lions Lemma and applications to evolution equations”.

TEACHING EXPERIENCE

Instructor 2021-2023

Department of Mathematics, University of Wisconsin-Madison

114 Algebra & Trigonometry (Spring 2023),
421 The Theory of Single Variable Calculus (Fall 2021/22),
521 Analysis I (Spring 2022).

Course supervisor 2019-2021

Faculty of Mathematics, University of Cambridge

Part II Analysis of Functions (LT 2020/21),
Part II Probability and Measure Theory (MT 2020),
Part IB Analysis and Topology (MT 2020).

Class tutor 2018-2019

Mathematical Institute, University of Oxford

B4.3 Distribution theory and Fourier analysis (MT 2018),
C4.4 Hyperbolic equations (HT 2019),
CDT Introduction to PDEs (MT 2018).

Teaching assistant 2016-2017

Mathematical Institute, University of Oxford

B4.1 Banach spaces (MT 2016),
B8.1 Martingales through measure theory (MT 2016),
CDT Hyperbolic PDEs (TT 2017).

College tutor 2016-2018

Magdalen College, The Queen's College, St Edmund Hall College (Oxford)

A4 Lebesgue integration (HT 2018),
A10 Fluid dynamics and waves (HT 2017/18).

REFERENCES

- Dr Maria Bruna, `bruna@maths.cam.ac.uk`
- Prof. Gui-Qiang Chen, `Gui-Qiang.Chen@maths.ox.ac.uk`
- Prof. Mikhail Feldman, `feldman@math.wisc.edu`
- Prof. Denis Serre, `denis.serre@ens-lyon.fr`
- Prof. Endre Süli, `suli@maths.ox.ac.uk`

Teaching activities

Simon Schulz

Supervision of Masters projects:

- **Stage M1 Mathématiques de l'ENS Lyon** *"Unicité pour les solutions à valeur dans les mesures" par Thomas Gamet (Summer 2021):* supervision (co-supervision with Dr Angeliki Menegaki) of a three-month long research project (May-August).
- **Part III Essay** *"The Aubin–Lions Lemma and applications to evolution equations" by Oscar De Wit (first two terms of the academic year 2020-21):* suggesting a research topic along with a reading list for an essay for the Masters year at University of Cambridge. After several encounters with the student to discuss content, structure, and layout of the essay, it was also my responsibility to grade the submission.

Lecturing of one-semester courses (42 hours per course, *i.e.*, 14 weeks) at University of Wisconsin–Madison:

- **Math 421 The Theory of Single Variable Calculus (Fall 2021/22).** *Introductory analysis for functions of one variable. The course covers the first 14 chapters of the book "Calculus" by M. Spivak.* Program: methods of proof (direct, contradiction, induction), limits of functions and sequences, continuity and uniform continuity, differentiability, Riemann integration, and the Fundamental Theorem of Calculus.
- **Math 521 Analysis I (Spring 2022).** *Elaboration of the previous course, with generalisation to metric spaces. The course covers the first 7 chapters of the book "Principles of Mathematical Analysis" by W. Rudin.* Program: real numbers, metric spaces, open and closed sets, compactness, sequences and series, continuity on metric spaces, differentiability on $\mathbb{R}$, Riemann–Stieltjes integration on a real interval, Taylor's Theorem, uniform convergence and sequences of real functions on metric spaces, Dini and Arzelà–Ascoli Theorems.

It was my responsibility to lecture as well as create the contents of the course (notes, homeworks, exams), using the books mentioned as a base.

Small group tutorials (4 hours per group per term) at University of Cambridge:

- **Part IB Analysis & Topology (Autumn 2020).** *2nd year course: analysis for multivariate functions, metric and topological spaces.* Program: uniform continuity and uniform convergence on subsets of $\mathbb{R}$, Banach Contraction Theorem and application to ODEs (Cauchy–Lipschitz Theorem), differentiability in multiple dimensions, metric and topological spaces, open and closed sets, notions of continuity and compactness in metric and topological spaces, homeomorphisms, connectedness, and quotient topology.
- **Part II Analysis of Functions (Spring 2020/21).** *3rd year course.* Program: recalls on Hilbertian analysis and measure theory, mollification and Schwartz functions, Radon–Nikodym Theorem, Vitali Covering Lemma and applications to the Hardy–Littlewood maximal function and to the Lebesgue Differentiation Theorem, distribution theory, Fourier analysis and tempered distributions, Sobolev spaces, and periodic distributions.
- **Part II Probability & Measure Theory (Autumn 2020).** *3rd year course.* Program: σ-algebras and measures, measurable functions, Lebesgue integration, Monotone and Dominated Convergence Theorem, L^p spaces, Fubini and Tonelli Theorems, probability spaces, random variables, independence, Borel–Cantelli Lemmas, Kolmogorov 0-1 Law, Fourier transform, weak convergence of measures, Law of large numbers, Central Limit Theorem, Birkhoff and von Neumann Ergodic Theorems.

It was also my responsibility to provide my solutions to the problem sheets and to grade homeworks.

Tutorials in groups of twelve (4 hours per group per term) at University of Oxford:

- **B4.3 Distribution theory & Fourier analysis (Autumn 2018).** *3rd year course.* Program: recalls on measure theory, mollification and Schwartz functions, Fourier analysis and tempered distributions, Sobolev spaces, periodisation and Poisson summation formula.
- **C4.4 Hyperbolic equations (Spring 2019).** *Masters course.* Program: method of characteristics, Rankine–Hugoniot condition and Lax entropy condition, non-uniqueness of weak solutions for Burgers equation, Cole–Hopf transformation, functions of bounded variation, the wave equation, energy method and Grönwall's Lemma, Huygens principle and Kirchoff formula.
- **PDE CDT Introduction to PDEs (Autumn 2018).** *Introductory graduate course.* Program: linear equations, classical and weak solutions, Poisson's equation on the whole space and the Poisson kernel, heat equation on the whole space and heat kernel, method of characteristics, d'Alembert's solution of the wave equation, non-uniqueness of weak solutions to Burgers equation.

It was also my responsibility to provide my solutions to the problem sheets.

Tutorials in groups of four (4 hours per group per term) à University of Oxford:

- **A4 Lebesgue integration (Spring 2018).** *2nd year course.* Program: σ-algebras, measures, measurable funcions, Lebesgue integration, Monotone and Dominated Convergence Theorems, Fubini Theorem.
- **A10 Fluid mechanics & waves (Spring 2017/18).** *2nd year course.* Program: irrotational incompressible flows, velocity potential, solution of Laplace's equation using complex variables.

It was also my responsibility to provide my solutions and to grade homework problems.

Teaching assitant at University of Oxford (homework grading):

- **B4.1 Banach spaces (Spring 2016).** *3rd year course.* Program: normed vector spaces, spaces of sequences and functions, complete spaces, finite and infinite-dimensional vector spaces, linear operators, Hahn–Banach Theorem, spectral theory of operators.
- **B8.1 Martingales & measure theory (Spring 2017/18).** *3rd year course.* Program: recalls on measure theory, probability spaces, random variables, independence, filtrations, conditional expectation, martingales, Doob's Optional Stopping Theorem.
- **PDE CDT Hyperbolic PDE (Summer 2017).** *Graduate course.* Program: conservation laws, hyperbolic systems, entropy solution, vanishing viscosity method, Young measures, div-curl Lemma, compensated compactness, wave equations, Huygens principle and Kirchoff formula.