Sylvie Benzoni-Gavage

Curriculum vitae

Institut Camille Jordan
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Research Interests

PDEs Hyperbolic, dispersive, and Hamiltonian partial differential equations.
Nonlinear waves: shocks, phase transitions, solitons, periodic waves.
Boundary value problems and free boundary problems.
Delay differential equations, lattice dynamical systems.

Modeling Compressible fluid dynamics, traffic flow, two-phase flows with surface tension.
Phase field models.

Professional Positions

Since 2003 **Professor**, *Université Claude Bernard Lyon 1*, MAPLY, then Institut Camille Jordan

1992–2003 **CNRS Researcher**, *École normale supérieure de Lyon*, UMPA

1990–1992 **Teaching Assistant**, *École normale supérieure de Lyon*, Mathematics Department

Education and Degrees

1998 Habilitation to Supervise Research, Université Claude Bernard Lyon 1

1991 PhD in Mathematics, Université Claude Bernard Lyon 1

1989 Agrégation in Mathematics

1986–1990 Student at École normale supérieure Saint-Cloud then Lyon

Administrative Responsibilities

2018–2024 **Director**, *Institut Henri Poincaré*, IHP - CNRS & Sorbonne Université

2018–2024 **Scientific manager**, *Excellence laboratory Carmin*, IHP - IHÉS - CIRM - CIMPA

2018–2024 **Chair**, *Association Publications de l'Institut Henri Poincaré*

2016–2017 **Director**, *Institut Camille Jordan*, ICJ - CNRS, Université Claude Bernard Lyon 1, Centrale Lyon, Insa Lyon, Université Jean Monnet Saint-Étienne

2011–2015 **Deputy Director**, ICJ - ICJ - CNRS, Université Claude Bernard Lyon 1, Centrale Lyon, Insa Lyon, Université Jean Monnet Saint-Étienne

2006–2009 **Director**, *Modelling, asymptotics and nonlinear dynamics*, CNRS Research Group

Teaching Responsibilities

2005–2009 **Chair**, *Undergraduate studies in mathematics*, Université Claude Bernard Lyon 1

Editorial activities

2017–2023 **Board Member**, *Centre Mersenne*

2015–2023 **Editor**, Annales de la Faculté des Sciences de Toulouse

2013–2022 **Editor**, Journal de l'École Polytechnique

2010–2019 **Editor**, Confluentes Mathematici

Reviewing and Expert Evaluations

Reviewer for ANR (French National Research Agency), ERC (European Research Council), and other international funding bodies.

Participation in expert panels : IUF (Institut Universitaire de France), DFG (Deutsche Forschungsgemeinschaft).

Member of several hiring committees each year in France or abroad.

Member of several PhD juries each year, mostly in France.

PhD and Postdoctoral Supervision

Since 1999 Supervised 5 PhD theses in Mathematics, mostly in the field of nonlinear PDEs.

Also mentored postdoctoral researchers and advised master's theses.

Public Science Communication

Since 2009 Involved in outreach activities to promote mathematics to a broader audience, including public lectures, workshops, books, videos, artwork, and media appearances.

2018–2024 Overseeing the design, and scientific curator of the Maison Poincaré, a maths museum hosted by the Institut Henri Poincaré, open since 2013.

Multiple contributions to temporary exhibitions and events at IHP.

Conference Organization

Since 2001 Organized or co-organized numerous scientific events, workshops, and conferences.

Invitations

○ Research stays abroad

2024 **Isaac Newton Institute / Northumbria University**, *Newcastle, UK*, Programme « Emergent phenomena in nonlinear dispersive waves », 2 weeks

2022 **Isaac Newton Institute**, *Cambridge, UK*, Semester « Dispersive hydrodynamics », Kirk Distinguished Visiting Fellow, 8 weeks

2015 **Gran Sasso Science Institute**, *L'Aquila, Italy*, 2 weeks

2015 **Department of Applied Mathematics**, *Brown University, USA*, 2 weeks

○ International courses

Since 2010 Delivered lectures in summer schools at graduate level, *Italy, France, Vietnam*

○ Invited research talks

In international conferences (+30), national conferences (+20), seminars (+15)

Publications

Journals

[J1] **S. Benzoni-Gavage**, C. Mietka, and L. M. Rodrigues. Modulated equations of Hamiltonian PDEs and dispersive shocks. *Nonlinearity*, 34(1):578–641, 2021.

[J2] **S. Benzoni-Gavage**, C. Mietka, and L. M. Rodrigues. Stability of periodic waves in Hamiltonian PDEs of either long wavelength or small amplitude. *Indiana Univ. Math. J.*, 69(2), 2020.

[J3] **S. Benzoni-Gavage** and D. Chiron. Long wave asymptotics for the Euler–Korteweg system. *Revista Matemática Iberoamericana*, 34(1):245–304, 2018.

[J4] **S. Benzoni-Gavage**, C. Mietka, and L. M. Rodrigues. Co-periodic stability of periodic waves in some Hamiltonian PDEs. *Nonlinearity*, 29(11):3241, 2016.

[J5] **S. Benzoni-Gavage**, P. Noble, and L. M. Rodrigues. Slow modulations of periodic waves in Hamiltonian PDEs, with application to capillary fluids. *J. Nonlinear Sci.*, 24(4):711–768, 2014.

[J6] F. Chambat, **S. Benzoni-Gavage**, and Y. Ricard. Jump conditions and dynamic surface tension at permeable interfaces such as the inner core boundary. *Comptes Rendus Geoscience*, 346(5-6):110–118, 2014. Earth's inner core.

[J7] **S. Benzoni-Gavage**. Planar traveling waves in capillary fluids. *Differential Integral Equations*, 26(3-4):433–478, 2013.

[J8] **S. Benzoni-Gavage**, Laurent Chupin, D. Jamet, and J. Vovelle. On a phase field model for solid-liquid phase transitions. *Discrete and Continuous Dynamical Systems*, 32(6):1997–2025, 2012.

[J9] **S. Benzoni-Gavage** and J.-F. Coulombel. On the amplitude equations for weakly nonlinear surface waves. *Archive for Rational Mechanics and Analysis*, 205(3):871–925, 2012.

[J10] **S. Benzoni-Gavage**, J.-F. Coulombel, and Nikolay Tzvetkov. Ill-posedness of nonlocal Burgers equations. *Advances in Mathematics*, 227(6):2220–2240, 2011.

[J11] **S. Benzoni-Gavage**. Spectral transverse instability of solitary waves in Korteweg fluids. *J. Math. Anal. Appl.*, 361(2):338–357, 2010.

[J12] **S. Benzoni-Gavage** and M. D. Rosini. Weakly nonlinear surface waves and subsonic phase boundaries. *Comput. Math. Appl.*, 57(3-4):1463–1484, 2009.

[J13] **S. Benzoni-Gavage**. Local well-posedness of nonlocal Burgers equations. *Differential Integral Equations*, 22(3-4):303–320, 2009.

[J14] **S. Benzoni-Gavage**, D. Serre, and K. Zumbrun. Transition to instability of planar viscous shock fronts: the refined stability condition. *Z. Anal. Anwend.*, 27(4):381–406, 2008.

[J15] **S. Benzoni-Gavage**, R. Danchin, and S. Descombes. On the well-posedness for the Euler-Korteweg model in several space dimensions. *Indiana Univ. Math. J.*, 56:1499–1579, 2007.

[J16] **S. Benzoni-Gavage**, R. Colombo, and P. Gwiazda. Measure valued solutions to conservation laws motivated by traffic modeling. *Proc. R. Soc. Lond. Ser. A Math. Phys. Eng. Sci.*, 462(2070):1791–1803, 2006.

[J17] **S. Benzoni-Gavage**, R. Danchin, and S. Descombes. Well-posedness of one-dimensional Korteweg models. *Electronic J. Diff. Equations*, 2006(59):1–35, 2006.

[J18] **S. Benzoni-Gavage**, R. Danchin, S. Descombes, and D. Jamet. Structure of Korteweg models and stability of diffuse interfaces. *Interfaces Free Boundaries*, 7:371–414, 2005.

[J19] **S. Benzoni-Gavage** and H. Freistühler. Effects of surface tension on the stability of dynamical liquid-vapor interfaces. *Arch. Ration. Mech. Anal.*, 174(1):111–150, 2004.

[J20] **S. Benzoni-Gavage** and R. Colombo. An n-populations model for traffic flow. *European J. Appl. Math.*, 14:587–612, 2003.

[J21] **S. Benzoni-Gavage**, J.-F. Coulombel, and S. Aubert. Boundary conditions for Euler equations. *AIAA Journal*, 41(1):56–63, 2003.

[J22] **S. Benzoni-Gavage**, P. Huot, and F. Rousset. Nonlinear stability of semi-discrete shock waves. *SIAM J. Math. Anal.*, 35(3):639–707, 2003.

[J23] **S. Benzoni-Gavage**. Stability of semi-discrete shock profiles by means of an Evans function in infinite dimensions. *J. Dynam. Differential Equations*, 14(3):613–674, 2002.

[J24] **S. Benzoni-Gavage** and P. Huot. Existence of semi-discrete shocks. *Discrete Contin. Dyn. Syst.*, 8(1):163–190, 2002.

[J25] **S. Benzoni-Gavage**, F. Rousset, D. Serre, and K. Zumbrun. Generic types and transitions in hyperbolic initial-boundary-value problems. *Proc. Roy. Soc. Edinburgh Sect. A*, 132(5):1073–1104, 2002.

[J26] J.-F. Coulombel, **S. Benzoni-Gavage**, and D. Serre. Note on a paper: "Shock wave instability and the carbuncle phenomenon: same intrinsic origin?" [J. Fluid Mech. **417** (2000), 237–263; MR 2001e:76083] by J.-Ch. Robinet, J. Gressier, G. Casalis and J.-M. Moschetta. *J. Fluid Mech.*, 469:401–405, 2002.

[J27] **S. Benzoni-Gavage**. Linear stability of propagating phase boundaries in capillary fluids. *Phys. D*, 155(3-4):235–273, 2001.

[J28] **S. Benzoni-Gavage**, D. Serre, and K. Zumbrun. Alternate Evans functions and viscous shock waves. *SIAM J. Math. Anal.*, 32(5):929–962 (electronic), 2001.

[J29] **S. Benzoni-Gavage**. Nonuniqueness of phase transitions near the Maxwell line. *Proc. Amer. Math. Soc.*, 127(4):1183–1190, 1999.

[J30] **S. Benzoni-Gavage**. Stability of subsonic planar phase boundaries in a van der Waals fluid. *Arch. Ration. Mech. Anal.*, 150(1):23–55, 1999.

[J31] **S. Benzoni-Gavage**. Semi-discrete shock profiles for hyperbolic systems of conservation laws. *Phys. D*, 115(1-2):109–123, 1998.

[J32] **S. Benzoni-Gavage**. Stability of multi-dimensional phase transitions in a van der Waals fluid. *Nonlinear Anal.*, 31(1-2):243–263, 1998.

[J33] **S. Benzoni-Gavage**. On a representation formula for B. Temple systems. *SIAM J. Math. Anal.*, 27(6):1503–1519, 1996.

[J34] **S. Benzoni-Gavage** and D. Serre. Compacité par compensation pour une classe de systèmes hyperboliques de $p \geq 3$ lois de conservation. *Rev. Mat. Iberoamericana*, 10(3):557–579, 1994.

- Proceedings

[P1] **S. Benzoni-Gavage** and J.-F. Coulombel. Amplitude equations for weakly nonlinear surface waves in variational problems. In F. Colombini, D. Del Santo, and D. Lannes, editors, *Shocks, Singularities and Oscillations in Nonlinear Optics and Fluid Mechanics*. Springer INdAM Series, 2017.

[P2] **S. Benzoni-Gavage**, P. Noble, and L.M. Rodrigues. Stability of periodic waves in Hamiltonian PDEs.F In *GDR Analyse des EDP*, volume 2013. cedram, 2013.

[P3] **S. Benzoni-Gavage**, J.-F. Coulombel, and N. Tzvetkov. Ondes de surface faiblement non-linéaires. In *Séminaire Laurent Schwartz — EDP et applications*, volume 2011-2012. cedram, 2012.

[P4] **S. Benzoni-Gavage** and J.-F. Coulombel. Multi-d shock waves and surface waves. In *Hyperbolic problems: Theory, Numerics and Applications, (June 9-13, 2008, University of Maryland)*, volume 67, Part 1 of *Proceedings of Symposia in Applied Mathematics*, pages 3–23. American Mathematical Society, 2009.

[P5] **S. Benzoni-Gavage**, R. Danchin, S. Descombes, and D. Jamet. Stability issues in the Euler-Korteweg model. In *Joint Summer Research Conference* Control methods in PDE-Dynamical Systems, volume 426 of *Contemporary Mathematics*, pages 103–127. AMS, 2007.

[P6] **S. Benzoni-Gavage**, R. Danchin, S. Descombes, and D. Jamet. On Korteweg models for fluids exhibiting phase changes. In *Hyperbolic problems: theory, numerics, applications, (Osaka, 2004)*, volume I, pages 311–318. Yokohama Publishers, Yokohama, 2006.

[P7] **S. Benzoni-Gavage**. On the stability of large amplitude semidiscrete shock profiles by means of an Evans function in infinite dimensions. In *Hyperbolic problems: theory, numerics, applications, Vol. I, II (Magdeburg, 2000)*, volume 141 of *Internat. Ser. Numer. Math., 140*, pages 149–157. Birkhäuser, Basel, 2001.

[P8] **S. Benzoni**. Multi-dimensional stability of propagating phase boundaries. In *Hyperbolic problems: theory, numerics, applications, Vol. I (Zürich, 1998)*, volume 129 of *Internat. Ser. Numer. Math.*, pages 41–45. Birkhäuser, Basel, 1999.

[P9] **S. Benzoni-Gavage**. Sur la stabilité de profils de choc semi-discrets au moyen d'une fonction d'Evans en dimension infinie. *C. R. Acad. Sci. Paris Sér. I Math.*, 329(5):377–382, 1999.

[P10] **S. Benzoni-Gavage** and D. Serre. Compensated compactness for a class of hyperbolic systems of p conservation laws with $p \geq 3$. In *Progress in partial differential equations: the*

Metz surveys, 2 (1992), volume 296 of *Pitman Res. Notes Math. Ser.*, pages 3–11. Longman Sci. Tech., Harlow, 1993.

[P11] **S. Benzoni-Gavage** and D. Serre. Existence of solutions for a class of hyperbolic systems of p conservation laws $(p \geq 3)$. In *Nonlinear hyperbolic problems: theoretical, applied, and computational aspects (Taormina, 1992)*, volume 43 of *Notes Numer. Fluid Mech.*, pages 56–61. Vieweg, Braunschweig, 1993.

- Monographs

[B1] **S. Benzoni-Gavage**. *Calcul différentiel et équations différentielles.* Cours et exercices corrigés. Dunod, Collection Sciences Sup, 2010 (1st edition), 2014 (2nd edition).

[B2] **S. Benzoni-Gavage** and D. Serre. *Multi-dimensional hyperbolic partial differential equations: First-order systems and applications*. Oxford University Press, Oxford, 2007.

- Outreach

[O1] **S. Benzoni-Gavage**. *Le Rulpidon sous toutes ses coutures. Une aventure mathématique et artistique.* Dunod, Collection Quai des Sciences, 2024.

[O2] **S. Benzoni-Gavage** et R. Coulon. *Le dessous des cartes du rulpidon*, Pour la Science n°558, 2024.

[O3] **S. Benzoni-Gavage**. *The Rulpidon and 9-color maps*. Proceedings of Bridges 2023: Mathematics, Art, Music, Architecture, Culture, pp 553–558, 2023.

[O4] **S. Benzoni-Gavage**. Bi-monthly column (2021–2025) in Sciences & Avenir – La recherche. Extended versions at math.univ-lyon1.fr/perso/sylvie-benzoni-gavage/chroniques.

[O5] **S. Benzoni-Gavage**. *Pourquoi j'aime les maths ?* Le petit Évariste n°5, 2023.

[O6] **S. Benzoni-Gavage**, C. Fermanian Kammerer, Y. Kosmann-Schwarzbach, C. Rojas-Molina et D. Rowe. *Emmy Noether, mathématicienne d'exception*, Collection Maison Poincaré [Regards Mathématiques], Société Mathématique de France, Paris, 2023, 32 pp.

[O7] **S. Benzoni-Gavage** et C. Nadal. *Concevoir un parcours permanent égalitaire - La Maison Poincaré s'attaque à la sous-représentation des femmes en mathématiques*, in *Guide pour un musée féministe*, 2022.

[O8] **S. Benzoni-Gavage**. *La Musique des surfaces*, in Toshimasa Kikuchi - Objets mathématiques, Musée national des arts asiatiques - Guimet, 2021.

[O9] **S. Benzoni-Gavage**. *Le Rulpidon*, Images des mathématiques, 2021.

[O10] **S. Benzoni-Gavage**. *Comment les scientifiques s'organisent pour s'affranchir des aspects commerciaux des revues*, The Conversation, 2021.

[O11] **S. Benzoni-Gavage**, C. Fermanian Kammerer, M. Liewig et C. Nadal. *La Maison Poincaré*, Images des mathématiques, 2020.

[O12] **S. Benzoni-Gavage**. Blog posts on breves-de-maths.fr (ex mpt2013.fr): *Le bruit des océans et la coda des séismes*, *Alexandre Liapounoff et sa célèbre thèse*, *Pierre-Simon Laplace et le système du monde*, *Fourier et la température de la Terre*, *Prédire les inondations*, 2013.

[O13] **S. Benzoni-Gavage** et D. Serre. Blog post on breves-de-maths.fr: *Rayleigh et les tremblements de terre*, 2013.

[O14] **S. Benzoni-Gavage**. *Mathémusique*, preface of book by Javier Arbonés et Pablo Milrud, *L'harmonie est numérique*, Collection "Le monde est mathématique", RBA 2013.

[O15] **S. Benzoni-Gavage**. *Les stéréotypes ont la peau dure !*, preface of book by Joaquín Navarro, *Les femmes et les mathématiques*, Collection "Le monde est mathématique", RBA 2013.

- Miscellaneous

[M1] **S. Benzoni-Gavage**. *Françoise Pécaut-Tison, 1927–2023*, L'Archicube, n°37 bis, 2025.

[M2] **S. Benzoni-Gavage**. *The Maison Poincaré, a maths museum in a research centre*, Matematica, Cultura e Società – Rivista dell'Unione Matematica Italiana, special issue 2024.

[M3] **S. Benzoni-Gavage**. *The Maison Poincaré, a maths museum in France*, EMS Magazine n°132, 2024.

[M4] **S. Benzoni-Gavage** et C. Fermanian Kammerer. *L'extension de l'IHP : un chantier au long cours*, Gazette de la Société Mathématique de France n°177, 2023.

[M5] **S. Benzoni-Gavage**. *À propos des « role models »*, Gazette de la Société Mathématique de France n°175, 2023.

[M6] **S. Benzoni-Gavage** and M. Liewig. *The Maison Poincaré*, in *Handbook of Mathematical Science Communication* par Anna Maria Hartkopf et Erin Henning, 2023.

[M7] **S. Benzoni-Gavage** et É. Cheyrou. *La Maison Poincaré - Réinventer un lieu patrimonial*, Revue EAC DAAC'Tualité n°42, 2022.

[M8] **S. Benzoni-Gavage** et C. Fermanian Kammerer. *L'Institut Henri Poincaré - Projet d'extension et création de la Maison Poincaré*, Bulletin de la Commission française pour l'enseignement des mathématiques n°50, 2022.

[M9] **S. Benzoni-Gavage**. *Les bases mathématiques du perceptron*, 19 pages, 2022.

[M10] **S. Benzoni-Gavage**. *Le perceptron*, 24 pages, 2022.

[M11] G. Allaire, **S. Benzoni-Gavage** et M. Esteban. *Quand deux revues de l'Institut Henri Poincaré prennent la direction de l'Open Access: possibilités, difficultés et solutions*, Gazette de la Société Mathématique de France n°169, 2021.

[M12] **S. Benzoni-Gavage**. *Waves and their modulations*, 2020.

[M13] **S. Benzoni-Gavage**. *REDESSINER: Revisiting Decades of Conservation Laws*. Lyon, November 5–7, 2014. Confluentes Mathematici 7 (2015), no. 2, 3–6.

[M14] S. Benzoni-Gavage. *Yvette Kosmann-Schwarzbach, The Noether Theorems, Invariance and Conservation Laws in the Twentieth Century*, compte-rendu. Revue de synthèse, 133, 6e série, n^o 3 (2012).

[M15] S. Benzoni-Gavage, S. Descombes, C. Poignard et M. Ribot. *Michelle Schatzman, 1949–2010* Gazette des mathématiciens (2011), no. 127, 79–82 & Matapli (2010), no. 93, 53–58.

[M16] S. Benzoni-Gavage. *Propagating phase boundaries and capillary fluids*, Lecture notes of Summer school *Mathematical Fluid Dynamics*, Levico Terme (2010).

[M17] S. Benzoni-Gavage. *EDP dispersives*, Master Lecture notes (2009).

[M18] S. Benzoni-Gavage and R. Colombo. Modèles multi-classes. In *École d'automne Modélisation mathématique du trafic automobile (Paris, 27–29 nov. 2002)*. (Proceedings should have appeared in 2003).

[M19] S. Benzoni-Gavage. *Contributions à l'étude des solutions régulières par morceaux des systèmes hyperboliques de lois de conservation*. Habilitation dissertation, Université Lyon 1 (1998).

[M20] S. Benzoni-Gavage. *Méthodes directes en calcul des variations, quasiconvexité*. Journal de Maths des Élèves de l'ENS Lyon, 1 No. 3 (1995).

[M21] S. Benzoni-Gavage. *MathSciNet*, 58 reviews between 1997 and 2013.