

Charles Collot

Born in 1990. French nationality. One child.

Current Position and research field

2022 - **Chaire Professeur Junior**, CY Cergy Paris Université (CYU), France.

I am interested in qualitative properties of solutions of nonlinear evolution partial differential equations. My topics of research include:

- Dynamics near solitons, traveling waves, self-similar solutions and steady states.
- Singularity formation and long time dynamics.
- Certain statistical physics problems: weak wave turbulence, dynamics of infinitely many particles.
- Parabolic equations (semilinear heat equation and Keller-Segel system), dispersive equations (semilinear wave and Schrödinger equations, Gross-Pitaevskii equation, Hartree-Fock equation), fluid mechanics models (Prandtl's system, Burgers-type equations, Primitive equations, incompressible porous medium equation), kinetic equations (kinetic wave equation)

Awards and fundings

- 2023- **P.I. of the ERC starting grant FloWAS "Flows, Waves, and their Asymptotic Stability"**.
- 2023- **Member of the ANR project BOURGEONS "Boundaries, Congestion and Vorticity in Fluids: A connection with environmental issues"**, P.I. Anne-Laure Dalibard.
- 2022- **P.I. of the ANR-22-CPJ2-0018-01 project Chaire professeur junior "Analyse harmonique et mécanique des fluides"**.
- 2022- **Co-P.I. of the CY Initiative Emergence project "CYngular Fluids and Interfaces"**, other co-P.I. Christophe Prange.
- 2021- **Member of the CY Initiative project CY Nonlinear Analysis**, P.I. Philippe Gravejat.

Past positions

- 2020-2022 **Chargé de Recherches**, Centre National de la Recherche Scientifique (CNRS), CY Cergy Paris Université, France.
- 2018-2020 **Courant Instructor**, New York University, Courant Institute, New York, U.S.A..
- 2017-2018 **Postdoctoral Associate**, New York University in Abu Dhabi, Abu Dhabi, U.A.E..

Education

- 2014-2017 **Ph.D. with P. Raphaël "On critical and supercritical blow-up for the semi-linear heat and wave equations"**, Université Nice Côte d'Azur, Nice, France.

UFR Sciences et Techniques AGM - Département mathématiques

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Defended on November 8, 2016,

Rapporteurs: T. Cazenave, N. Masmoudi, Jury: T. Cazenave, G. Lebeau, F. Merle, P. Raphaël, L. Vega.

2011-2013 **Master's Degree "Partial Differential Equations and Numerical Calculation" with first class honors**, *École Normale Supérieure and Orsay University*, Paris.

2010-2011 **Bachelor's Degree**, *École Normale Supérieure*, Paris, France.

2008-2010 **Classe préparatoires MPSI-MP***, *Lycée Malherbe*, Caen, France.

Preprints and publications

Stable self-similar singularity formation for infinite energy solutions of the incompressible porous medium equations, 34 pages *arXiv:2507.17381*, submitted, with C. Prange and J. Tan.

Remark on the energy channel property for the radial linear wave equation, 4 pages, to appear in *Comptes Rendus Mathématiques* in a volume in honour of H. Brezis, with T. Duyckaerts, C. Kenig and F. Merle.

Absence of embedded spectrum for nonlinear Schrödinger equations linearized around one dimensional ground states, 6 pages *arXiv:2503.02957*, to appear in *Proceedings of the American Mathematical Society*, with P. Germain and E. Pacherie.

Estimates for the Gross-Pitaevskii equation linearized around a vortex, 106 pages *arXiv:2503.02953*, submitted, with P. Germain and E. Pacherie.

Singularity formed by the collision of two collapsing solitons in interaction for the 2D Keller-Segel system, 142 pages *arXiv:2409.05363*, submitted, with T.-E. Ghoul, N. Masmoudi and V. T. Nguyen.

On the stability of Type I self-similar blowups for the Keller-Segel system in three dimensions and higher, 39 pages *arXiv:2406.11358*, submitted, with K. Zhang.

Stability of homogeneous equilibria of the Hartree-Fock equation, for its equivalent formulation for random fields, *Probability and Mathematical Physics*, 6(1), 241-279 (2025), with E. Danesi, A.-S. de Suzzoni and C. Maleze.

Asymptotic Stability of Solitary Waves for One Dimensional Nonlinear Schrödinger Equations, 106 pages *arXiv:2306.03668*, To appear in *Journal of the European Mathematical Society*, with P. Germain.

On classification of non-radiative solutions for various energy-critical wave equations, *Advances in Mathematics*, 434, 109337 (2023), with C. Kenig, T. Duyckaerts and F. Merle.

On channels of energy for the radial linearised energy critical wave equation in the degenerate case, *International Mathematics Research Notices*, rnac288 (2022), with C. Kenig, T. Duyckaerts and F. Merle.

Stability and cascades for the Kolmogorov-Zakharov spectrum of wave turbulence, *Archive for Rational Mechanics and Analysis*, 248(1), 7 (2024), with H. Dietert and P. Germain.

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Soliton resolution for the radial quadratic wave equation in six space dimensions, *Vietnam Journal of Mathematics*, 52(3), 735-773 (2024), with C. Kenig, T. Duyckaerts and F. Merle.

Collapsing-ring blowup solutions for the Keller-Segel system in three dimensions and higher, *Journal of Functional Analysis*, 285(7) 110065 (2023), with T.-E. Ghoul, N. Masmoudi and V. T. Nguyen.

Stable Singularity Formation for the Inviscid Primitive Equations, *Annales de l'Institut Henri Poincaré. Analyse Non Linéaire*, 41(2), 317-356 (2023), with S. Ibrahim and Q. Lin.

Derivation of the kinetic wave equation for quadratic dispersive problems in the inhomogeneous setting, *American Journal of Mathematics*, 147(4), 1053-1158 (2025), with I. Ampatzoglou and P. Germain.

Derivation of the homogeneous kinetic wave equation: longer time scales, *Journal of Functional Analysis*, 290(1), 111179 (2025), with P. Germain.

Stability of Steady States for Hartree and Schrodinger Equations for Infinitely Many Particles, *Annales Henri Lebesgue*, 5, 429-490 (2022), with A.-S. de Suzonni.

On the derivation of the homogeneous kinetic wave equation, *Communications on Pure and Applied Mathematics*, 78(4), 856-909 (2025), with P. Germain.

Spectral analysis for singularity formation of the two dimensional Keller-Segel system, *Annals of PDEs*, 8(1), 5 (2022), with T.-E. Ghoul, N. Masmoudi and V.-T. Nguyen.

Refined description and stability for singular solutions of the 2D Keller-Segel system, *Communications on pure and applied mathematics*, 75(7), 1419-1516 (2022), with T.-E. Ghoul, N. Masmoudi and V.-T. Nguyen.

Singularities and unsteady separation for the inviscid two-dimensional Prandtl system, *Archive for Rational Mechanics and Analysis*, 240(3), 1349-1430 (2021), with T.-E. Ghoul and N. Masmoudi.

Stability of equilibria for a Hartree equation for random fields, *Journal de Mathématiques Pures et Appliquées*, 137, 70-100 (2020), with A.-S. de Suzonni.

On singularity formation for the two dimensional unsteady Prandtl system around the axis, *Journal of the European Mathematical Society*, 24(11), 3703-3800 (2022), with T.-E. Ghoul, S. Ibrahim and N. Masmoudi.

Singularity formation for Burgers equation with transversal viscosity, *Annales Scientifiques de l'École Normale Supérieure*, 55(4), 1047-1133 (2022), with T.-E. Ghoul and N. Masmoudi.

Strongly anisotropic type II blow up at an isolated point, *Journal of the American Mathematical Society*, 33(2), 527-607 (2020), with F. Merle and P. Raphaël.

On the stability of type I blow up for the energy super critical heat equation, *Memoirs of the American Mathematical Society*, 260(1255), (2019), with P. Raphaël and J. Szeftel.

Dynamics near the ground state for the energy critical nonlinear heat equation in large dimensions, *Communications in Mathematical Physics*, 352(1), 215-285 (2017), with F. Merle and P. Raphaël.

Stability of ODE blow-up for the energy critical semilinear heat equation, *Comptes Rendus Mathématique*, 355(1), 65-79 (2017), with F. Merle and P. Raphaël.

Non radial type II blow up for the energy supercritical semilinear heat equation, *Analysis & PDE*, 10(1), 127-252 (2017).

Type II blow up manifolds for a supercritical semi-linear wave equation, *Memoirs of the American Mathematical Society*, 252(1205) (2018).

Proceedings and reviews

Soliton resolution and channels of energy, *Advanced Nonlinear Studies*, (2025), with T. Duyckaerts, C. Kenig and F. Merle.

Self-similarity in the singularity formation for the Prandtl equations and related problems, *Seminaire Laurent Schwartz - EDP et applications*, 1-16 (2019).

Un resultat de diffusion pour l'equation de Hartree autour de solutions non localisees, *Seminaire Laurent Schwartz - EDP et applications*, 1-12 (2018), with A.-S. De Suzonni.

On blow-up and dynamics near ground states for some semi-linear equations, *Seminaire Laurent Schwartz - EDP et applications*, 1-12 (2016).

Supervision

2025- **Ph.D. of A. Lardot**, CYU.

2025- **Post-doctoral fellowship of F. Buseghin**, CYU.

2024- **Post-doctoral fellowship of Z. Li**, CYU.

2023-2024 **Post-doctoral fellowship of J. Tan**, CYU.

J. Tan is currently research assistant at The Chinese University of Hong Kong

2023-2024 **Ph.D. of K. Zhang**, one year exchange co-supervision with L. Ma, UST Beijing.

K. Zhang is lecturer at Dongguan University of Technology

2022- **Ph.D. of C. Maleze**, co-supervision with A.-S. de Suzzoni, École Polytechnique and CYU.

C. Maleze is currently professeur de classes preparatoires

2022- **Internships of Master students**, 3 supervisions, CYU.

Organization

2020- **Co-organizer of the AGM Colloquium and the Analysis and PDEs seminar**, CYU, Cergy-Pontoise.

2025 **CY Days in Nonlinear Analysis conference**, CYU, Neuville-sur-Oise, co-organizer.

2024 **"Nonlinear Partial Differential Equations" workshop**, NCTS, Taipei, with Van Tien Nguyen.

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- 2024 **"(In)-stability Phenomena in Fluids" summer school**, CYU, Cergy-Pontoise, with Christophe Prange.
- 2023 **"Advances in Nonlinear Analysis and Nonlinear Waves" conference, in honor of Frank Merle**, IHES and CYU, co-organizer.
- 2022 **CY Days in Nonlinear Analysis conference**, CYU, Neuville-sur-Oise, co-organizer.
- 2021 **Boundary layer day workshop**, CYU, Cergy-Pontoise, with C. Prange.
- 2014-2016 **Co-organizer of a J.A. Dieudonné Laboratory's PDE seminar, Co-organizer of the Ph.D. students' workshop, co-organizer of the Ph.D. students' seminar on PDEs and numerical analysis**, Université Nice Côte d'Azur, Nice.

Expertise

- 2025- **Member of the Direction Comitee of FSM (Fondation Sciences de la Modélisation)**, Ile-de-France.
- 2023- **Member of AGM department's council**, CYU, Cergy-Pontoise.
- 2022- **Reviewer for several national research agencies**, worldwide.
- 2020- **Member of AGM laboratory's council**, CYU, Cergy-Pontoise.
- 2017- **Reviewer for journals for 50+ articles**, including Ann. Maths, JAMS, Inventiones Math., JEMS, CPAM....
- 2025 **PhD jury member**, PhD defense of R. Zeitoun, CYU.
- 2022-2024 **Member of the Scientific Comitee of Labex MME DII**, Ile-de-France.
- 2024 **Member of PhD monitoring committee**, Ile-de-France.
- 2022 **Member of hiring comitee for assistant professor position, member of hiring comitee for postdoc position**, CYU, Cergy-Pontoise.
- 2014-2016 **Member of the PhD school council, member of L.J.A.D laboratory's council**, Université Nice Côte d'Azur, Nice.

Talks given at conferences and seminars

2026: workshop Nonlinear Waves and Dispersive Equations (Mar. Oberwolfach), conférence Journées Équations aux Dérivées Partielles (Jun. Aussois), Analysis of Partial Differential Equations arising in Physics, A satellite conference of the 2026 International Congress of Mathematicians (Jul. Rutgers)

2025: HCERES evaluation days (Jan. CYU), Sorbonne Paris Nord Analysis seminar (Jan. Villetaneuse), workshop "Nonlinear Waves and Hamiltonian PDE's" (Feb. Courmayeur), workshop "Vortices, Boundary Layers, and Instabilities" (Mar. Grenoble), Seoul National U. analysis seminar (Apr. Seoul), workshop on PDEs, Dynamical Systems and Applications (Apr. Taipei), Singularities and Asymptotic Patterns in Fluids and Evolutionary PDEs (May, Granada), U. Sciences and Technology of China analysis seminar (May Hefei online), summer school Analytical Methods in Quantum and Classical Mechanics (Jun. Torino), conference Nonlinear PDEs in Guimaraes (Jul. Guimaraes).

2024: Oxford analysis seminar (Jan. Oxford), workshop "Nonlinear Waves and Hamiltonian PDEs" (Feb. Courmayer), Zürich analysis seminar (May, U. Zürich), workshop "Singularity Formation for nonlinear PDEs" (Sep. Cambridge), workshop "Young researchers in

deterministic and probabilistic dispersive equations" (Oct. EPFL), AIMS conference (Dec. Abu Dhabi)

2023: LJLL seminar (Mar. Paris), ENS-Jussieu seminar (Mar. Paris), Warwick Analysis seminar (Mar. Warwick), Equilibria in dispersive and fluid PDEs conference (Apr. La Rochelle), NTU Analysis seminar (Apr. Taiwan), Ondes non-linéaires workshop (May Paris), International Conference on Structural Nonlinear Dynamics and Diagnosis (May Marrakech), Mathematical justification of the kinetic and fluid equations of plasmas and self-gravitating system (Jul. CIRM), Site Center seminar (Sept. NYUAD), Rencontre AGM-IDS (Sept. CYU), Korean AIST (Nov. online), Conference in Honor of Carlos Kenig (Dec. Monash University), Guest lecture CY IAS (Dec. CYU)

2022: SITE online conference: Long Time Behavior and Singularity Formation in PDEs-Part IV (Jan., Abu Dhabi, online), KIT workshop on wave phenomena (Feb., Karlsruhe, online), Calderon-Zygmund seminar (The Univ. of Chicago), Analysis Seminar (Brown Univ.), Syngflow ANR project meeting (Apr., Univ. Bordeaux), L.J.A.D. Analysis seminar (June, Nice), Nonlinear Waves and Dispersive Equations (June, Oberwolfach), Bath analysis seminar (Oct., Bath), Cambridge analysis seminar (Oct., Cambridge), Journée d'analyse des Hauts-de-France (Nov., Lille), National Taiwan University analysis seminar (Dec., Taipei, online).

2021: Joint meeting of the A.M.S (Jan., Washington, online), Lisbon WADE (Jan., online), Long Time Behavior and Singularity Formation in PDEs - Part II (Jan., Abu Dhabi, online), Spectral problems in Mathematical Physics seminar (Apr., Paris, online), Open PDE seminar (Apr., worldwide online), I.H.E.S Large-scale limits of interacting particle systems workshop (Oct., Paris), BIRS workshop Singularity Formation in Nonlinear PDEs (Oct., Banff online), I.C.E.R.M. Generic Behavior of Dispersive Solutions and Wave Turbulence workshop (Oct., Brown), London PDE seminar (Oct., online), Cambridge kinetic reading group (Nov., online), NYUAD seminar (Nov., Abu Dhabi),

2020: CAMS Colloquium at University of Southern California (Jan., Los Angeles), Paris 13 Analysis Seminar (Mar., Villetaneuse), Institut Mathématiques de Bordeaux analysis seminar (Apr., Bordeaux), Shanghai Tech PDE Seminar (Apr., Shanghai), Long Time Behavior and Singularity Formation in PDEs conference (May, Abu Dhabi), NCTS PDE and Analysis Seminar (Jun., Taipei), Princeton Analysis Seminar (Sep., Princeton), Lyon Analysis Seminar (Nov., Lyon)

2019: New York University in Abu Dhabi (Jan., U.A.E.), University of Sharjah (Jan., U.A.E), Fluid dynamics seminar (Feb. Princeton), Columbia (Apr., New York), Waves Cote d'Azur conference (Jun., Nice), Advances in Dispersive Equations workshop (Jul., Banff, Canada), minicourse given at USTC (Aug., Hefei, China), University of Maryland (Oct., Washington), Effective Equations in Quantum Physics session of AMS joint meeting (Gainesville, Florida), Brown University (Nov., Providence), University of British Columbia (Dec., Canada)

2018: Conference in honor of Lin and Shatah (Jan., Abu Dhabi), University of Victoria (Jan., Victoria), Courant Institute (Feb., New York), Journées Jeunes EDPistes (Mar., Nancy), Université libre de Bruxelles (Jun., Bruxelles), Conference Jeunes Chercheurs en EDP dispersives (Jun., Paris), Nonlinear Waves Conference (Jul., Karlsruhe), Courant Instructors day (Oct., New York), Cergy-Pontoise university seminar (Nov., Paris), Courant Institute (Dec., Paris).

2017: Journées jeunes EDPistes (Mar., Autrans), Lille university (May), Paris Dauphine university (May), Strasbourg university (Jun.), Nonlinear Waves and Dispersive Equations (Jun., Oberwolfach), Analyse asymptotique des équations d'évolution (Jul., C.I.R.M, Marseille), Nonlinear equations and singularity formation (Oct., Pauli Institute, Vienne), analysis seminar (Nov., American University of Sharjah).

2016: Ph.D. students seminar (Jan., Nice), Imperial college (Fev., London), Ph.D. students in sciences day (May, Nice), Laurent Schwartz seminar at IHES (May, Paris), Orsay University (Oct., Paris), Ph.D. students seminar (Oct., Rennes), Second Workshop on Evolution Equations (Dec., Valdivia, Chile).

2015: Ph.D. students seminar (May, Nice), Ph.D. students workshop (June, Nice), Ph.D. students seminar (Oct., Berkeley).

2014: workshop of the analysis team of Nice (Sep., Lecco), analysis team seminar (Nov., Nice).

Long term stays

Spring 2025: Invited for three weeks at Seoul National U. and Taiwan National U.

Spring 2024: invited to "Nonlinear Waves and Relativity" program at ESI, Vienna.

Summer 2023: Mini-course at Chinese Academy of Science, Beijing

Spring 2023: Invited for three weeks at National Taiwan University.

Winter 2022: one month at Courant Institute and The University of Chicago, New York and Chicago.

Summer 2019: Mini-course at University of Science and Technology of China, Hefei.

Spring 2019: Invited researcher for two months at IHÉS, Bures-sur-Yvettes.

Winter 2019: Invited researcher for one month at NYUAD, Abu Dhabi.

Spring 2018: Invited researcher for three months at IHÉS, Bures-sur-Yvettes.

Winter 2018: One month at Courant Institute, New York.

Fall 2015: Program associate for "New Challenges in PDE" at MSRI, Berkeley.

Spoken languages

French and English (fluent), Spanish (intermediate).

Teaching

2022-2024 **Dynamics of parabolic equations**, CY Cergy Paris Université.

2022-2024 **Python programming**, CY Cergy Paris Université.

2022-2023 **Fourier Analysis**, CY Cergy Paris Université.

2021-2022 **Introduction to mathematical modelling**, CY Cergy Paris Université.

2019-2020 **Linear Algebra Instructor**, New York University.

2018-2019 **Analysis Instructor**, New York University.

2018-2019 **Calculus I Instructor**, New York University.

2016-2017 **Tutorial in mathematics for economy (first year BA), tutorial in statistics for economy (first year BA)**, Université Nice Côte d'Azur.

2014-2016 **Course in mathematics for biology (first year BA), tutorial in discrete mathematics (first year BA)**, Université Nice Côte d'Azur.