Curriculum Vitae

Arthur Touati

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Personal information

- *Nationality*   French,
- *Birth*   August 1995 in Bordeaux, France,
- *Address*   Institut des Hautes Etudes Scientifiques, Office 0N7

  35 route de Chartres, 91440 Bures-sur-Yvette, France,
- *Mail*   `touati@ihes.fr`,
- *Website*   arthurtouati.fr,
- *Languages*   French (mothertongue), English (professional), German (B1 level).

Positions

- *2025-?*   **CNRS young researcher** at IMB (Université de Bordeaux).
- *2022-2024*   **Postdoc** Huawei Young Talents Program at IHES.

Education

- *2019-2022*   **PhD** at CMLS (Ecole Polytechnique):
  - Advisor: Cécile Huneau,
  - Title: Construction of high-frequency spacetimes,
  - Defended on October 6th 2022,
  - Referees: Lars Andersson and David Lannes,
  - Jury: Lars Andersson, Cécile Huneau, David Lannes, Frédéric Rousset, Jacques Smulevici and Jérémie Szeftel,
- *2017-2019*   **Master in mathematics** at Université Paris-Sud,
- *2016-2017*   **Licence in mathematics** at Université Paris-Sud,
- *2015-2016*   **Licence in physics** at Université Paris-Sud,
- *2015-2019*   Student in physics and mathematics at **Ecole Normale Supérieure**, Paris,
- *2013-2015*   Student in *Classes préparatoires PCSI-PC** at Lycée Louis-le-Grand.

Research interests

I am interested in the mathematical theory of **general relativity**. My research is twofold:

- construction of high-frequency solutions to the Einstein vacuum equations,

- stability of black holes as solutions to the Einstein vacuum equations.

For these two programs, I'm interested in both the hyperbolic and elliptic aspects, i.e the evolution equations and the constraint equations.

Keywords: mathematical general relativity, Einstein equations, Burnett conjecture, geometric optics, black holes, constraint equations.

Articles & preprints

In reverse chronological order taking into account the first release on the arXiv.

7. **Spacelike initial data for black hole stability** (with Allen Juntao Fang & Jérémie Szeftel) Preprint arXiv:2405.02071.

6. **The reverse Burnett conjecture for null dusts** Preprint arXiv:2402.17530.

5. **Initial data for Minkowski stability with arbitrary decay** (with Allen Juntao Fang & Jérémie Szeftel) Preprint arXiv:2401.14353, accepted in *Advances in Theoretical and Mathematical Physics*.

4. **High-frequency solutions to the constraint equations** *Commun. Math. Phys*, 402(1):97-140, 2023.

3. **Geometric optics approximation for the Einstein vacuum equations** *Commun. Math. Phys*, 402(3):3109-3200, 2023.

2. **Global existence of high-frequency solutions to a semi-linear wave equation with a null structure** *Asymptotic Analysis*, 131(3-4):541–582, 2023.

1. **Einstein vacuum equations with $\mathbb{U}(1)$ symmetry in an elliptic gauge: local well-posedness and blow-up criterium** *Journal of Hyperbolic Differential Equations*, 19(04):635–715, 2022.

Articles 2, 3 and 4 above compose my PhD thesis.

Proceedings

1. **Geometric optics approximation for the Einstein vacuum equations** *Séminaire Laurent Schwartz — EDP et applications*, Exposé no. 7, 12 p. (2022-2023)

Seminar & conferences

- *2024*
  - **Singularity formation for nonlinear PDEs**, Cambridge University,
  - **Mathematical GR and Hyperbolic PDE Seminar**, Columbia University,
  - **Séminaire de Géométrie**, LMPT Tours,
  - **Vienna Relativity Seminar**, University of Vienna,
  - **Seminar of Differential Equations and Numerical Analysis**, University of Crete,
  - **Séminaire de l'équipe Analyse Numérique-EDP**, LMO Orsay,
  - **Séminaire Mathématique-Physique**, IMB Dijon,

- – **Séminaire d'analyse**, LMJL Nantes,

- *2023*

  - – **Séminaire de Physique Mathématique EDP**, IMB Bordeaux,
  - – **Greater Paris Postdocs in Mathematics Welcome Day**, IHES,
  - – **Evolution Equations Workshop**, IHES,
  - – **Séminaire Analyse & EDP**, CY AGM,
  - – **Journée des Jeunes EDPistes**, Tours,
  - – **Gravity Initiative Seminar**, Princeton University,
  - – **Séminaire du laboratoire**, LMR Reims,
  - – **London PDE Seminar**, Imperial-UCL-Queen Mary London,
  - – **Séminaire de physique mathématique**, Institut Fourier Grenoble,
  - – **Groupe de lecture en relativité générale**, LJLL Sorbonne Université.

- *2022*

  - – **Séminaire Laurent Schwartz**, CMLS-IHES,
  - – **Séminaire EDP**, IRMAR Université Rennes 1,
  - – **Mathematical GR and Hyperbolic PDE Seminar**, Columbia University,
  - – **Topics in general relativity**, WWU Münster,
  - – **HADES Seminar**, Berkeley University,
  - – **Analysis & PDE Seminar**, Stanford University,
  - – **Séminaire EDP et Physique mathématique**, LAGA Université Sorbonne Paris Nord.

- *2021*

  - – **Vienna Relativity Seminar**, University of Vienna,
  - – **Seminar on Mathematical General Relativity**, LJLL Sorbonne Université,
  - – **Séminaire des doctorants du CMAP et du CMLS**, Ecole Polytechnique,"How to solve Einstein's equations?",
  - – **Groupe de travail en analyse**, CMLS Ecole Polytechnique.

- *2020* **Groupe de lecture en relativité générale**, LJLL Sorbonne Université, on the article *Nonlinear interaction of impulsive gravitational waves* of Luk and Rodnianski,

- *2019* **Séminaire des doctorants ANH et ANEDP**, LMO Orsay, "Le problème de Cauchy en relativité générale et les équations d'Einstein dans une jauge elliptique".

Organization

- *2024* **Turbulent·e·s**, Conference at Ecole Polytechnique on May 23rd & 24th (co-organised with Anne-Sophie de Suzzoni, Guillaume Dubach and Annalaura Stingo),

- *2022-2024* **Groupe de lecture en relativité générale**, LJLL Sorbonne Université.

Teaching

- *2024-2025*   Lecturer of MAT568 **Wave equations and general relativity** for the third year engineers students of Ecole Polytechnique with Anne-Sophie de Suzzoni,

- *2022-2023*   Lecturer (in English) of MAA310 **Measure and Integration (Condensed)** for the third year of the Bachelor of Science of Ecole Polytechnique,

- *2019-2022*   Tutorials (in English) for the Bachelor of Science of Ecole Polytechnique MAA202 **Topology and multivariable calculus**,

- *2015-2019*   Oral interrogations in mathematics in **Classes Préparatoires aux Grandes Ecoles** in Lycées Louis-le-Grand and Henri IV.

Supervision

- *2022-2023*   PSC (Projet Scientifique Collectif), four second year Polytechnique students working on the Gregory-Laflamme instability,

- *2022 (Mai to June)*   Antoine Peyronnet, L3 internship from ENS Rennes, on approximate solutions of the Einstein-Maxwell system.

Other activities

- *2022-2023*   Member of the press review writing team for the website **Images des mathématiques**,

- *2022*   "Trous noirs : sont-ils stables ?", short popular piece on **Polytechnique Insights website**,

- *2021*   "Ecrire un livre de vulgarisation scientifique pendant sa thèse", interview on **IP-Paris website**,

- *2021*   Guest of **La Conversation Scientifique** on France Culture hosted by Etienne Klein (June 26th 2021),

- *2021*   Writing and publication (First Editions) of **Voyage au coeur de l'espace-temps**, a popularization book on relativity,

- *2018-2020*   **Animath**, organization of week-ends for high-school girls around mathematics and coaching of several teams for french tournaments,

- *2017*   **Savoir Pour Tous** (presentation for high-school student avalaible on Youtube), "Vers l'infini et au-delà..."