

# Alfred Kirsch

CERMICS, École des Ponts ParisTech  
119 rue de Charonne, 75011 PARIS

alfred.kirsch@enpc.fr, +33 6 98 21 97 33  
<https://alfred-kirsch.github.io/>

## Summary

With a training in Mathematics and Physics, I am currently doing my PhD in Mathematics at CERMICS, École des Ponts under the supervision of Éric Cancès and David Gontier (PhD defense on 11/18/2024).

The subject is to mathematically analyse *embedding methods* such as Density Matrix Embedding Theory (DMET) or Dynamical Mean-Field Theory (DMFT). During my PhD, I have been involved in many teaching, the supervision of an intern and the organization of the bimonthly Young Researchers seminar at CERMICS (École des Ponts ParisTech).

## Preprints

- Cancès, Éric, Fabian M. Faulstich, Alfred Kirsch, Eloïse Letournel, and Antoine Levitt. «Some mathematical insights on Density Matrix Embedding Theory». arXiv, 2023. <https://doi.org/10.48550/arXiv.2305.16472>. Submitted to Communications on Pure and Applied Mathematics.
- Cancès, Éric, Alfred Kirsch, et Solal Perrin-Roussel. «A mathematical analysis of IPT-DMFT». arXiv, 2024. <https://doi.org/10.48550/arXiv.2406.03384>.
- Cancès, Éric, Alfred Kirsch and Solal Perrin-Roussel. «A mathematical analysis of the discretized IPT-DMFT equations.» 2024, in preparation.

## Publications

- Schäfer, Thomas, Nils Wentzell, Fedor Šimkovic, Yuan-Yao He, Cornelia Hille, Marcel Klett, Christian J. Eckhardt, Alfred Kirsch et al. «Tracking the Footprints of Spin Fluctuations: A MultiMethod, Multi-Messenger Study of the Two-Dimensional Hubbard Model». Physical Review X 11, n° 1 (23 mars 2021): 011058. <https://doi.org/10.1103/PhysRevX.11.011058>.

## Education

- National selective exam for teaching abilities ("Agrégation") in Physics, rank: 10, Paris, 2021.
- Masters degree at International Centre for Fundamental Physics, Quantum Physics option, École Normale Supérieure, Paris, 2018-2019.
- Masters degree at École Polytechnique, "Cycle ingénieur", major : Mathematics and Physics, Paris area, 2015-2019.
- Selective exams preparation at Montaigne highschool, Bordeaux, 2013-2015.

## Current position

PhD in applied mathematics at CERMICS under the supervision of David Gontier and Éric Cancès. Subject: "A mathematical analysis of embedding methods in quantum mechanics." 2021-.

## Academic Employment

- Physics internship at Collège de France and École Polytechnique, under the supervision of Michel Ferrero and Antoine Georges. Subject: "Compétition des effets de conduction et de magnétisme du modèle de Hubbard dans l'approximation de la théorie du champ moyen dynamique." June 2019.
- Mathematics internship at CERMICS under the supervision of David Gontier and Éric Cancès. Subject: "The mathematics of strongly interacting electrons." June 2021.

## Academic Services

- Organizer of the Young Researchers seminar at CERMICS, 2021-.
- Weekly oral exams in Mathematics and Physics ("colles" in "classes préparatoires") at Voltaire, Saint-Louis highschools and Institut Bossuet (Paris), 2019-2023.
- Popularization talks "Initiation à la physique statistique : la température et les foules" for the Journées Nationales des Cordées de la Réussite, 2021-2024.

## Invited Talks

- Some mathematical insights on DMET (jointly with É. Letournel), EMC2 Seminar, Paris, May 2023.
- Some mathematical insights on DMET, GDR REST General Meeting, Oléron, June 2023.
- Mathematical insights on DMFT on a Hubbard model, Model Systems in Quantum Mechanics, Toulouse, January 2024.
- A mathematical analysis of IPT-DMFT, Young Researchers Symposium, International Congress of Mathematical Physics, Strasbourg, June 2024.
- A mathematical analysis of IPT-DMFT, EMC2 Roscoff'24, Roscoff (France), July 2024.

## Schools and conferences

- IPAM Advancing Quantum Mechanics with Mathematics and Statistics, UCLA, Los Angeles, March-June 2022.
- International Summer School on Computational Quantum Materials, Usherbrooke, Sherbrooke, July 2022.

- CCQ Moire Materials Meeting, Flatiron Institute Simons Foundation, New York, May 2023.
- GDR NBODY Mini-schools, UPMC Paris, June 2022,2023.
- GDR Rest General Meeting, Oléron, June 2023.
- TRIQS General Meeting, Collège de France, Paris, September 2023.
- BIRS Workshop on Moire Superlattices, Banff, October 2023.
- Workshop on Model Systems in Quantum Mechanics, Université Paul Sabatier, Toulouse, January 2024.

## Poster Sessions

Some mathematical insights on Density Matrix Embedding Theory, Precision Many-Body workshop, Collège de France Paris, June 2023.

## Teaching Experiences

- Electromagnetism (Physics oriented), Université Gustave Eiffel, 2021-2022.
- Introduction to Statistical Physics (Physics oriented), École des Ponts, 2021-2023.
- Introduction to Quantum Physics (Mathematics oriented), École des Ponts, 2021-2024.
- Solid-state physics: theory and applications (Physics oriented), École des Ponts, 2021-2023.
- Electrons in a crystal: theory and applications (Mathematics oriented), École des Ponts, 2023-2024.

## Students

Maxime Vinteler (undergraduate student), subject: "Modèle de Hubbard". June-July 2023.

## Languages

Native French. Fluent English and Spanish. Beginner German and Swedish. Learning Italian.

Last update: August 2024.