Alfred Kirsch

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Summary

With a training in Mathematics and Physics, I am currently doing postdoctoral researches in Applied Mathematics at CERMICS, École des Ponts and Matherials Inria (Paris), with Éric Cancès as a mentor.

The subject is to mathematically analyze Dynamical Mean-Field Theory (DMFT). During my Ph.D. (defended on 11/18/2024), I was interested in *embedding methods* such as Density Matrix Embedding Theory (DMET) and DMFT. I have been involved in various teachings, the supervision of an intern and the organization of the bimonthly Young Researchers Seminar at CERMICS (École des Ponts ParisTech).

Preprints

- Cancès, É., Faulstich, F. M., Kirsch, A., Letournel, E., Levitt, A. (2023). Some mathematical insights on density matrix embedding theory. arXiv preprint arXiv:2305.16472. https://doi.org/10.48550/arXiv.2305.16472. Accepted in Communications on Pure and Applied Mathematics.
- Cancès, É., Kirsch, A., Perrin-Roussel, S. (2024). A mathematical analysis of IPT-DMFT. arXiv preprint arXiv:2406.03384.arXiv, 2024. https://doi.org/10.48550/arXiv.2406.03384.
- Cancès, É., Kirsch, A., Perrin-Roussel, S. A mathematical analysis of the discretized IPT-DMFT equations. 2024, in preparation.

Publications

- Schäfer, T., Wentzell, N., Šimkovic IV, F., He, Y. Y., Hille, C., Klett, M., ... Kirsch., A., ..., Georges, A. (2021). Tracking the footprints of spin fluctuations: A multimethod, multimessenger study of the two-dimensional Hubbard model. Physical Review X, 11(1), 011058.https://doi.org/10.1103/PhysRevX.11.011058.

Current position

Postdoctoral researcher at CERMICS and Matherials. Mentor: Éric Cancès. Subject: "The mathematical foundations of Dynamical Mean-Field Theory".

Invited Talks

- A mathematical analysis of IPT-DMFT, EMC2 Roscoff '24, Roscoff (France), July 2024.
- A mathematical analysis of IPT-DMFT, Young Researchers Symposium, International Congress of Mathematical Physics, Strasbourg, June 2024.

- Mathematical insights on DMFT on a Hubbard model, Model Systems in Quantum Mechanics, Toulouse, January 2024.
- Some mathematical insights on DMET, GDR REST General Meeting, Oléron, June 2023.
- Some mathematical insights on DMET (jointly with É. Letournel), EMC2 Seminar, Paris, May 2023.

Poster Sessions

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

Teaching Experiences

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

Students

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

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 high schools, and Institut Bossuet (Paris), 2019-2023.
- Popularization talks " Initiation à la physique statistique : la temperature et les foules" for the Journées Nationales des Cordées de la Réussite, 2021-2024.

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 Supérieur, 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.

Academic Employment

- PhD in applied mathematics at CERMICS and Matherials under the supervision of David Gontier and Éric Cancès. Subject: "A mathematical analysis of embedding methods in quantum mechanics." 2021-2024.
- Mathematics internship at CERMICS under the supervision of David Gontier and Éric Cancès. Subject: "The mathematics of strongly interacting electrons." June 2021.
- 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.

Schools and conferences

- Workshop on Model Systems in Quantum Mechanics, Université Paul Sabatier, Toulouse, January 2024.
- BIRS Workshop on Moire Superlattices, Banff, October 2023.
- GDR Rest General Meeting, Oléron, June 2023.
- GDR NBODY Mini-schools, UPMC Paris, June 2022,2023,2024.
- TRIQS General Meeting, Collège de France, Paris, September 2023.
- CCQ Moire Materials Meeting, Flatiton Institute Simons Foundation, New York, May 2023.
- Internationnal Supper School on Computationnal Quantum Matherials, USherbrooke, Sherbrooke, July 2022.
- IPAM Advancing Quantum Mechanics with Mathematics and Statistics, UCLA, Los Angeles, March-June 2022.

Languages

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

Native Python (TRIQS user). Fluent Julia.

Last update: December 2024.