

Philipp Alexander Kreer

Physics PhD at Technical University of Munich & Apart Research Fellow

philipp.a.kreer@outlook.de | Munich, Germany

 [philipp-alexander-kreer.github.io](https://github.com/philipp-alexander-kreer) |  [philipp-alexander-kreer](https://www.linkedin.com/in/philipp-alexander-kreer) |  [Philipp-Alexander-Kreer](https://orcid.org/Philipp-Alexander-Kreer)





PROFESSIONAL PROFILE

Resilient, interdisciplinary theoretical physicist at the frontier of particle physics, general relativity, and the science of deep learning. Five first-authored journal publications and multiple public talks demonstrate my investigative and interdisciplinary research. In my PhD, I specialized in the mathematics of scattering amplitudes for Higgs physics and black hole dynamics. I complemented my analytic problem-solving skills with hands-on experimentation on large language models during my Apart Research Fellowship. In the PostDoc, I will apply my unique skill set to advance research in: AI solutions to particle physics, distributional shifts of AIs in particle physics, explainable AI systems, and mathematical foundations of AI systems.

CORE SKILLS

- Scout Mindset
- Scientific Integrity
- Interdisciplinary Communication
- Problem-oriented Writing & Programming
- Polyglot (German, Hungarian, English, Spanish, French)
- Python (PyTorch, pandas, detailed list in appendix)
- Large Language Model Experimentation
- Scattering amplitudes in Quantum Field Theory
- Integration of Feynman Integrals

SELECTED PROJECTS

- **Sandbag Detection through Model Degradation**   1 July 2024
Winning AGI Deception Detection Hackathon, Accepted to NeurIPS 2024
 - Developed a PyTorch noise injection algorithm to perturb parameters of frontier large language models (Llama-3.1-70B) to detect strategic underperformance (sandbagging).
 - Detected a variety of fine-tuned, password-locked, and prompted sandbagging models.
 - Key finding: As suggested by physics-inspired singular learning theory, sandbagging is a shallow property.
 - 8th October 2024: 25min plenary talk at [high-energy physics conference in Bonn](#).
- **Mathematica package TTH**   15 March 2024
Published in Journal of High Energy Physics
 - Key result: Package to evaluate the probability density functions for $t\bar{t}H$ particle production at the Large Hadron Collider in CERN. Reducing the evaluation time from non-executable on a CPU cluster (2 TB RAM, 200 cores) to 2–3 minutes on my laptop.
 - Key challenge: Identifying a compact representation of high-multiplicity scattering amplitudes with multiple massive particles and evaluating Feynman integrals with many massive legs.

GRANTS & FELLOWSHIPS

- **Apart Research Fellowship** Since 01.06.2024
- **Swiss-European Mobility Programme:** 880 CHF + 2000 CHF 21.01.2020
- **Deutscher Akademischer Austausch Dienst (DAAD) Grant:** 275 EUR 20.12.2019
- **Erasmus+:** 1440 EUR 03.07.2018

SEMINAR & CONFERENCES

P=PARTICIPATION, C=CONFERENCE TALK, S=SEMINAR TALK

- [C1] Kreer, P. A. (8 October 2024). *AI Alignment: A Problem of Diversity and Particle Physics*, [Bonn Fall High-Energy Physics Meeting 2024: Embracing Diversity in High Energy Physics](#), 25-min plenary talk: [slides](#).
- [S3] Kreer, P. A. (17 July 2024). *Sandbag Detection through Model Degradation*, Prague, Czech Republic.
- [S2] Kreer, P. A. (9 February 2024). *Massive Scattering Amplitudes*, Florida State University, Remote.
- [S1] Kreer, P. A. (9 – 12 January, 2024). *$gg \rightarrow t\bar{t}H$ @ 1 loop @ ε^2* , University of Zurich/Paul Scherrer Institut, Zurich, Switzerland.

TEACHING

- **Bachelor Thesis Supervision** April 2023 – September 2023
Form Factors in Massless and Massive Spinor Helicity Formalism
- **Teaching Assistant** March 2016 – March 2023
Technical University of Munich/Johannes Gutenberg-Universität
Munich, Germany
Covered Courses: Classical mechanics, classical electrodynamics, classical field theory, advanced quantum field theory, experimental particle physics, theoretical quantum mechanics, mathematical preparation course.

EDUCATION

- **Technical University of Munich** October 2021 – October 2025 (presumably)
PhD in Theoretical High Energy Physics
Munich, Germany
- **Johannes Gutenberg-Universität** October 2019 – July 2021
M.Sc. in Physics: Calculation of Feynman Integrals for Black Holes
Mainz, Germany
Final grade 1.0 (GPA: 4.00)
- **University of Zurich** February – May 2020
Research Exchange on Effective Field Theories
Zurich, Switzerland
Hosted by Prof. Gino Isidori and Prof. Daniel Wyler
- **Université de Toulouse III – Paul Sabatier** September 2018 – January 2019
Sciences of the Universe and Space Technology
Toulouse, France
Erasmus exchange semester
- **Johannes Gutenberg-Universität** October 2016 – July 2019
B.Sc. in Physics: Maximal Cuts in Baikov Representation
Mainz, Germany
Final grade 1.4 (GPA: 3.60)
- **Camino de Santiago** July 2016 – September 2016
1600 km through France and Spain
Le Puy-en-Velay – Santiago de Compostela

VOLUNTEER EXPERIENCE

- **Operational Manager in Foodsaving** May 2019 – September 2022 (3 years)
Foodsharing e.V.
 - Supervised a team responsible for daily collections of surplus food.
 - Managed partnerships with supermarkets while navigating strict legal and regulatory frameworks in Germany's food sector, ensuring compliance with food safety laws.
 - Developed and implemented new policies to streamline operations within existing legal restrictions, demonstrating diplomatic skills in negotiations and policy initiation.