

Dr. Matthew Herbst

Marie Skłodowska-Curie Postdoctoral Fellow
at Aalto University, Finland.

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Profile

Eight years of experience in the design, construction, and characterization of devices and experiments at ultra-low temperatures. Current scientific focus on optomechanical systems used for high-precision force sensing. Experienced in most cleanroom micro-fabrication techniques, and expert in the operation of optomechanical systems, cryogenic X-ray detectors, SQUIDs, and dilution refrigerators. Supervision of undergraduate students and lab courses.

Education

- 2019 – 2023 **PhD** in physics (grade: **magna cum laude 1.0**), Heidelberg University
PhD Thesis: *High Resolution Magnetic Micro-calorimeters: Thermodynamics, Cooling Requirements, and Noise* - Being able to operate cryogenic microcalorimeters such as MMCs at higher temperatures widens their application range. This thesis covers the simulation, design, and characterization of two new high- T MMCs, one for $T = 85\text{mK}$ and one for $T = 100\text{mK} - 300\text{mK}$. As a prerequisite, I also present detailed simulations of the highly concentrated Au:Er sensor material, and a new device to measure magnetic flux noise.
Advisor: Prof. Ch. Enss
- 2016 – 2018 **Master of Science** in physics (grade: **very good 1.1**), Heidelberg University
- 2012 – 2016 **Bachelor of Science** in physics (grade: **very good 1.5**), Heidelberg University
- 2005 – 2012 **Abitur** (average grade: **very good 1.5**), St. Raphael Gymnasium Heidelberg

Work Experience

- Oct 2023 – present **Postdoctoral Researcher** at Aalto University:
- research on gravity using optomechanical systems
- Aug 2023 – Sep 2023 **Postdoctoral Researcher** at the Kirchhoff Institute for Physics:
- research on $1/f$ noise in superconducting microstructures
- Feb 2019 – Jul 2023 **Scientific Assistant** at the Kirchhoff Institute for Physics:
- research on low temperature detectors, complex materials, noise
- supervision of Bachelor students and undergraduate lab courses
- cleanroom micro-fabrication of superconducting devices
- Jan 2019 – Feb 2019 **Student Assistant** at the Kirchhoff Institute for Physics:
- measurement of the specific heat of Au:Ho alloys at low temperatures
- Mar 2013 – Apr 2013 **Student Assistant** at the Max Planck Institute for Astronomy
- characterization of a K-mirror de-rotator for the Large Binocular Telescope

Grants and Awards

- 2025 **Marie Skłodowska-Curie Postdoctoral Fellowship** (Score: 98%, Value: 226k€, Proposal: 101198933 – *mGramm*)
- 2025 **Hannu Koskinen Presentation Prize 2025** (best of 70 oral presentations at Physics Days 2025)
- 2016 **Erasmus+ Grant** (6-month exchange to Padova, Italy)

Selected Publications

- 2023 **Herbst, M. et al.** Measuring Magnetic $1/f$ Noise in Superconducting Microstructures and the Fluctuation-dissipation Theorem. *Supercond. Sci. Technol.* **36**, 105007 (2023). DOI: 10.1088/1361-6668/acf166
- 2022 **Herbst, M. et al.** Numerical Calculation of the Thermodynamic Properties of Silver Erbium Alloys for Use in Metallic Magnetic Calorimeters. *J Low Temp Phys* **209**, 1119–1127 (2022). DOI: 10.1007/s10909-022-02739-3
- 2021 **Herbst, M., Reifenberger, A., Velte, C. et al.** Specific Heat of Holmium in Gold and Silver at Low Temperatures. *J Low Temp Phys* **202**, 106–120 (2021). DOI: 10.1007/s10909-020-02531-1

Further Qualifications

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|-----------------|---|
| Languages | - English, German: native
- Italian (B1), Finnish (A2) |
| Computer skills | - Programming: Python, Mathematica, LabView, Matlab
- Chip + circuit board design: Cadence Virtuoso, Autodesk Eagle
- 3D modelling, animating, and printing: Blender, Solidworks
- Outreach and publishing: LaTeX, Adobe Illustrator, MS Office |
| Hardware skills | - operation of dilution refrigerators (by Bluefors and Oxford Instruments)
- photolithographic techniques: sputtering, structuring of resist, etching, ...
- sample and device preparation: arc melting, soldering, bonding, ...
- quality control of samples: magnetization measurements, SEM imaging |

May 2025