Matthew Herbst

Postdoctoral Researcher at Aalto University,
Low Temperature Laboratory,
Puumiehenkuja 2B, 02150 Espoo, Finland

e-mail matthew.herbst@aalto.fi
website www.matthewherbst.net

Profile

Six years of experience simulating, developing, and performing experiments at millikelvin temperatures. Science focus on cryogenic micro-calorimeters and noise analysis in such devices. Practical knowledge in clean-room micro-fabrication, and cryostat operation. Supervision of Bachelor and Master students, as well as lab courses for undergraduate students.

Education

2019 – 2023 **PhD** in physics, Heidelberg University

Advisors: Christian Enss, Andreas Fleischmann, Loredana Gastaldo

PhD Thesis: *High Resolution Magnetic Micro-calorimeters: Thermodynamics, Cooling Requirements, and Noise* - Being able to operate microcalorimeters such as MMCs at high temperatures widens their application range significantly. This thesis covers the simulation, design, and characterization of two new MMCs, one for T = 85mK and one for T = 100mK - 300mK. As a prerequisite, we also present detailed simulations of the highly concentrated Au:Er sensor material, and a new device to measure magnetic flux noise.

2016 – 2018 **Master of Science** in physics, Heidelberg University

Master's Thesis: *Specific Heat of Dilute Alloys of Holmium and Noble Metals at Low Temperatures* - At millikelvin temperatures, the specific heat of silver holmium alloys is dominated by the complex magnetic nature of holmium. This thesis presents specific heat measurements of a variety of Ag:Ho alloys, which then allowed the neutrino mass experiment ECHo to implement these materials.

2012 – 2016 **Bachelor of Science** in physics, Heidelberg University

2005 – 2012 **Abitur**, St. Raphael Gymnasium Heidelberg

Work Experience

Oct 2023 – present	**Postdoctoral Researcher** at Aalto University - performing experiments with quantum nanomechanical systems
Feb 2019 – Sep 2023	**Scientific Assistant** at the Kirchhoff Institute for Physics: - research on low temperature detectors, complex materials, noise - simulation, design, and execution of experiments from the ground up - fabrication of devices in the cleanroom using photolithographic techniques - tutoring of Bachelor and Master students; lab courses for younger students - publishing results and presenting results at conferences
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 LBT

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
2023	**Herbst, M.** High Resolution Magnetic Micro-calorimeters: Thermodynamics, Cooling Requirements, and Noise, PhD thesis, Heidelberg University.
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.

Further Qualifications

Languages	- German: native - English: native - Italian: intermediate (B1)
Computer skills	- Programming: Python, Mathematica, LabView - Chip + circuit board design: Cadence Virtuoso, Autodesk Eagle - 3D modelling + Outreach: Blender, Solidworks, LaTeX, Adobe Illustrator
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, ...

October 2023