

# Franziska Maria Maier

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## Education

- 2020–now **CERN Doctoral student**  
PhD candidate at the University of Greifswald, Germany.  
Research work performed full time at ISOLDE/CERN.  
Supervisors: Stephan Malbrunot-Ettenauer, Lutz Schweikhard.
- 2017–2019 **Technical Physics - Master of Science with Honours**  
Johannes Kepler University, Linz, Austria.  
Master thesis about “*Laser Spectroscopy of Short-Lived Radionuclides in an Ion Trap: MIRACLS’ proof-of-principle experiment and the simulation of the future 30-keV MR-ToF device*”. Research work performed full time at ISOLDE/CERN.  
Supervisors: Thomas Klar, Stephan Malbrunot-Ettenauer, Lutz Schweikhard.
- 2013–2016 **Technical Physics - Bachelor of Science with Honours**  
Johannes Kepler University, Linz, Austria.  
Bachelor thesis about “*Difference Fluorescence Line-Narrowing Spectroscopy on Pigment-Protein Complexes*”, Institute for Theoretical Physics, Linz, Austria.  
Supervisors: Julian Adolphs, Thomas Renger.

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## Awards

- 09/2022 Best Poster Award at the TCP conference in Glashütten. There were in total 62 posters.
- 09/2022 LISA ITN Achievement Award for the outstanding research in laser spectroscopy presented at the LISA School ‘Structure of Complex Atoms’.
- 09/2020 Wilhelm Macke Master Thesis Prize at the Johannes Kepler University.
- 2013–2017 Study Achievement Award for excellent grades.

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## Scholarships

- 10/2022 Grant to cover the full conference fees awarded by the European Nuclear Physics Conference Organization.
- 2020–2023 Wolfgang Gentner Scholarship for my PhD at CERN.
- 2017–2019 Member of Pro Scientia.
- 2016 & 2018 IPS Stipendium des Landes Oberösterreich for the “Utrecht Summer School in Theoretical Physics” lead by Prof. Rembert Duine in 2016 and the research stay at CERN in 2018.
- 2018 Wilhelm Macke Mobilitätsstipendium for the research stay at CERN.
- 2016 Scholarship awarded by the Internationale Akademie Traunkirchen to take part in the workshop “Von Einstein zu Teleportation und Quantencomputer” lead by Prof. Anton Zeilinger.

## Outreach Experience

- Feb. 2023: Ambassador for science via the program “Femmes et filles de science et technologie” for the German School in Geneva.
- 2022–now: Tour guide of the ISOLDE facility for students, teachers and the general public.
- 2021–now: Responsible for the MIRACLS homepage.
- 2022: Participation in one video for CERN's Science Gateway Exhibition for the general public.
- 2022: First author of the article “Doppler and sympathetic cooling for the investigation of short-lived ions” in the ISOLDE Newsletter for 2022.

## Talks and Poster Presentations

- 2x Invited Seminar High Flux Mass Separation and Highly Sensitive Laser Spectroscopy in MR-ToF Devices, Seminar at LP2i, Bordeaux & Seminar at FRIB, East-Lansing, 2023.
- Talk Optimisation of the MIRACLS components for MR-ToF mass separation, PUMA collaboration meeting, CERN, 2023.
- Seminar Simulation and Experimental Study for a Highly Selective and High-Flux MR-ToF Mass Separator, ISOLDE Seminar, CERN, 2023.
- Talk Towards a Highly Selective and High Flux Mass Separator for Medical Applications, Medical Applications Project Forum, CERN, 2022.
- Poster Towards a Highly Selective and High Flux MR-ToF Mass Separator, ISOLDE workshop, CERN, 2022.
- 3x Talk, 3x Poster Highly-Sensitive Photodetachment Spectroscopy in an MR-ToF Device. DESIREE Symposium, Stockholm & LISA Summer School, Normandy & TCP conference, Glashütten & EuNPC, Santiago de Compostela & Physikerinnentagung, Karlsruhe, 2022 & DPG Spring Meeting, Hanover, 2023.
- Seminar, The MIRACLS Technique: In-Trap Laser Spectroscopy for Nuclear Structure Studies.
- 2x Invited Seminar Nuclear Physics Seminar, KTH Stockholm & Seminar für Kern- und Radiochemie, University of Mainz, 2022 & Seminar at University of Edinburgh, 2023.
- Talk The Multi Ion Reflection Apparatus for Highly Sensitive Laser Spectroscopy. Gentner Day, CERN, 2022.
- 3x Talk, 3x Poster Doppler- and Sympathetic Cooling for the Investigation of Short-Lived Radionuclides. ISOLDE seminar, CERN & ISOLDE Workshop and Users Meeting, CERN & Joliot International School, France, 2021 & ECCTI, CERN & TCP conference, Glashuetten, 2022 & DPG Spring Meeting, Hanover, 2023.
- Talk MIRACLS: From Proof of Principle Towards First Online Operation. ISOLDE Workshop and Users Meeting, CERN, 2020.
- Invited Talk Dem Atomkern auf der Spur - Mit der JKU ans CERN. Wilhelm Macke Master Thesis Prize Talk, Johannes Kepler University, Austria, 2020.
- Poster High Resolution Tomography of Mesoscopic Pore Structures. Status-Seminar of the CRC 1333, Germany, 2019.
- Poster Simulations of Ion Trajectories inside the Multi Ion Reflection Apparatus for Collinear Laser Spectroscopy (MIRACLS). ISOLDE Workshop and Users Meeting, CERN, 2018.
- 2x Talk Laser Spectroscopy of Short-Lived Radionuclides in an Ion Trap: MIRACLS' Proof-of-Principle Experiment. ISOLDE Seminar & Summer Student Session, CERN, 2017.

## Publications

F.M. Maier & E. Leistenschneider, et al. **Highly-Sensitive Photodetachment Spectroscopy in an MR-ToF Device.** *In preparation.*

Leading efforts for developing and commissioning of the new technique. E.Leistenschneider and I performed all the measurements and the analysis and we will write the manuscript together.

F.M. Maier, et al. **Study of the Drift Tube Length on the Performance of MR-ToF Devices.** *In preparation.*

Supported by my supervisors, I figured out that the drift tube length has a significant impact on the performance of MR-ToF devices for mass separation and laser spectroscopic applications. I developed the simulation code and performed all the simulations. In order to benchmark the simulation code, I carried out the measurements and the analysis supported by contributions from some of the co-authors. I currently write the manuscript.

F.M. Maier, F. Buchinger, L. Croquette, P. Fischer, H. Heylen, F. Hummer, C. Kanitz, A.A. Kwiatkowski, V. Lagaki, S. Lechner, E. Leistenschneider, G. Neyens, P. Plattner, A. Roitman, M. Rosenbusch, L. Schweikhard, S. Sels, M. Vilen, F. Wienholtz, S. Malbrunot-Ettenauer. **Increased Beam Energy as a Pathway Towards a Highly Selective and High-Flux MR-ToF Mass Separator.** *Submitted to Nucl. Instrum. Meth. A.*

I took the lead in performing the mass resolving power measurements, corresponding optimizations and some of the collisional excitation measurements. I developed most of the simulation code, performed the simulations and the analysis. Supported by my supervisor, I wrote the manuscript.

F.M. Maier, M. Vilen, I. Belosevic, F. Buchinger, C. Kanitz, S. Lechner, E. Leistenschneider, W. Nörtershäuser, P. Plattner, L. Schweikhard, S. Sels, F. Wienholtz, S. Malbrunot-Ettenauer. **Simulation Studies of a 30-keV MR-ToF Device for Highly Sensitive Collinear Laser Spectroscopy.** *Nucl. Instrum. Meth. A Vol 1048, 2023.*

I was largely involved in the conceptual design of the apparatus. I wrote the simulation code and performed the simulations. Supported by my supervisor, I wrote the manuscript.

S. Sels, F.M. Maier, M. Au, P. Fischer, C. Kanitz, V.Lagaki, S. Lechner, E. Leistenschneider, D. Leimbach, E.M. Lykiardopoulou, A.A. Kwiatkowski, T. Manovitz, G. Neyens, S. Rothe, L. Schweikhard, M. Vilen, R.N. Wolf, S. Malbrunot-Ettenauer. **Doppler- and Sympathetic Ion Cooling for the Investigation of Short-Lived Radionuclides.** *Phys. Rev. Res. 4, 033229, 2022.*

I coordinated many of the necessary modifications of the setup for laser cooling and lead many measurement campaigns, for which I also analysed the data. I developed simulation and calculation tools and performed the simulations. I also was involved in the finalization of the manuscript.

V. Lagaki, H. Heylen, I. Belosevic, P. Fischer, C. Kanitz, S. Lechner, F.M. Maier, W. Nörtershäuser, P. Plattner, M. Rosenbusch, S. Sels, L. Schweikhard, M. Vilen, F. Wienholtz, R.N. Wolf, S. Malbrunot-Ettenauer. **An Accuracy Benchmark of the MIRACLS Apparatus: Conventional, Single-Passage Collinear Laser Spectroscopy inside a MR-ToF Device.** *Nucl. Instrum. Meth. A Vol 1014, 2021.*

I coordinated many of the necessary modifications of the ion-optical apparatus for laser spectroscopic applications. I performed the initial ion optical tuning as well as first test measurements including the first isotope shift measurements and their analysis supported by contributions from other team members. I also did the field calculations in the Paul trap.

V. Lagaki, P. Fischer, H. Heylen, F. Hummer, S. Lechner, F.M. Maier, P. Plattner, M. Rosenbusch, S. Sels, F. Wienholtz, R. Wolf, W. Nörtershäuser, L. Schweikhard, S. Malbrunot-Ettenauer. **Stray-Light Suppression for the MIRACLS Proof-of-Principle Experiment.** *Acta Physica Polonica B Vol 51 571-576, 2020.*

I designed and installed the aperture tubes, set up the spatial filter and performed the very first stray-light reduction measurements allowing to reduce the laser-induced background by an order of magnitude.

S. Sels, P. Fischer, H. Heylen, V. Lagaki, S. Lechner, F.M. Maier, P. Plattner, M. Rosenbusch, F. Wienholtz, R. Wolf, W. Nörtershäuser, L. Schweikhard, S. Malbrunot-Ettenauer. **First Steps in the Development of the Multi Ion Reflection Apparatus for Collinear Laser Spectroscopy.** *Nucl. Instrum. Meth. B. Vol 467 310-314, 2020.*

I coordinated many of the necessary modifications of the ion-optical apparatus for laser spectroscopic applications. I performed the ion optical tuning and together with the other team members the measurements and analysis. I also was involved in setting up the laser system after the frequency doubler.

S. Lechner, P. Fischer, H. Heylen, V. Lagaki, F.M. Maier, P. Plattner, M. Rosenbusch, S. Sels, F. Wienholtz, R. Wolf, W. Nörtershäuser, L. Schweikhard, S. Malbrunot-Ettenauer. **Fluorescence Detection as a New Diagnostics Tool for Electrostatic Ion Beam Traps.** *Hyperfine Interactions 240:95, 2019.*

I wrote the simulation code, performed first test simulations and explained the simulation code to one PhD student who performed all the simulations discussed in this manuscript.

F.M. Maier, P. Fischer, H. Heylen, V. Lagaki, S. Lechner, P. Plattner, S. Sels, F. Wienholtz, W. Nörtershäuser, L. Schweikhard, S. Malbrunot-Ettenauer. **Simulations of a Proof-of-Principle Experiment for Collinear Laser Spectroscopy within a Multi-Reflection Time-of-Flight Device.** *Hyperfine Interactions* 240:54, 2019.

I wrote the simulation code and performed the simulations. Based on the simulation results, I coordinated necessary modifications of the ion-optical apparatus for laser spectroscopic applications. I performed the ion beam tuning, the measurements, analysis and the comparison to the simulations. I wrote the paper together with my supervisor.

J. Adolphs, F.M. Maier, T. Renger. **Wavelength-Dependent Exciton-Vibrational Coupling in the Water-Soluble Chlorophyll Binding Protein Revealed by Multi-Level Theory of Difference Fluorescence Line Narrowing.** *The Journal of Physical Chemistry B*, 122, 8891-8899, 2018.

Supported by my supervisors, I developed a new method for the calculation of difference fluorescence line-narrowing spectra, calculated the spectra and compared them with experimental data.