Raphael S. Maerkl

EDUCATION

Doctoral program (German Aerospace Center and University of Mainz) 06/2020 – 01/2025
German Aerospace Center (DLR), Institute of Atmospheric Physics
in the Cloud Physics Group of Prof. Christiane Voigt
Topic: Properties of contrails from aircraft with modern engines and alternative fuels
(German grade: 1.0* -- magna cum laude)

M.Sc. in Applied and Engineering Physics (German grade average: 1.4)* 10/2016 – 05/2019
Technical University of Munich
Master's thesis with Prof. P. Müller-Buschbaum at the Institute for Functional Materials
Title of thesis: *High-Performance Polymer and Novel Small Molecule for Titania-Based Hybrid Photovoltaics*
(German grade: 1.0)*

ERASMUS grant supported studies 08/2017 – 01/2018
Instituto Superior Técnico in Lisbon, Portugal

B.Sc. in Physics (German grade average: 1.95)* 10/2012 – 02/2016
Ludwig Maximilian University of Munich
Bachelor's thesis with Prof. J. Feldmann at the Chair for Photonics and Optoelectronics
Title of thesis: *Plasmonic Nanorod-TiO_2 Hybrids for Enhanced Photocatalysis* (German grade: 1.3)

Abitur (German grade average: 1.2)* 09/2004 – 06/2012
Gymnasium Tutzing

RESEARCH EXPERIENCE

German Aerospace Center (DLR), Institute of Atmospheric Physics 2020 – Expected late 2024
Doctoral candidate; Advisor: Prof. Christiane Voigt

- Analyzed in-situ data to investigate the influence of alternative jet fuels and modern lean-burn combustors on contrail ice particle number concentrations and particle size distributions
- Calibrated and maintained CAS-DPOL and CAPS-DPOL particle spectrometers and operated them in the DLR Falcon, HALO and NASA DC-8 research aircrafts and on the ground
- Developed Python software tools for efficient analysis and investigation of in-situ ice particle data

Technical University of Munich, Institute for Functional Materials 2018-2019
Master student; Advisor: Prof. Peter Müller-Buschbaum
Employed a wide range of research methods to characterize materials for the development of novel hybrid photovoltaic structures:

- Crystallographic and morphological characterization of thin films using neutron and X-ray scattering methods (ToF-GISANS, GISAXS, GIWAXS, XRD, XRR)
- Spectroscopic material characterization (UV-Vis and photoluminescence spectroscopy)
- Real space imaging (optical microscopy, AFM, SEM)

* German grading system: from 1: „very good" to 5: "failed"

RESEARCH CAMPAIGNS

Prepared and integrated instruments, analyzed data, supported flight planning and acted as scientific instrument operator as part of the following campaigns onboard flying research aircraft or on the ground:

- In-situ campaigns with a source and chase aircraft to investigate the influence of alternative fuels and/or modern combustion technologies on (ice) particle emissions and trace gases:
  - **EcoDemonstrator** Seattle 10/2023
  - **VOLCAN2** Oberpfaffenhofen, Toulouse 02-03/2023
  - **VOLCAN1** Oberpfaffenhofen, Toulouse 10-11/2021
  - **ECLIF3 Q4** Oberpfaffenhofen, Toulouse 10-11/2021
  - **ECLIF3 Q2** Oberpfaffenhofen, 04/2021
- In-situ campaign for the investigation of cirrus clouds and the effects of aviation at high latitudes compared to mid-latitudes:
  - **CIRRUS HL** Oberpfaffenhofen 06-07/2021
- Icing wind tunnel campaign to characterize a new spray system for supercooled large droplets:
  - **SENS4ICE** Braunschweig 07/2020

TEACHING AND MENTORING

German Aerospace Center (DLR) 2023

Mentoring of a master student during experimental work, data analysis and scientific evaluation during their master's thesis at DLR and the Technical University of Munich

University of Mainz 2022

Senior teaching assistant for the preparatory math course for "Experimental Physics I" (two semesters)

AWARDS/HONORS

ODAS Award: "The best paper prepared and presented by young scientists" Paris 06/2023

23rd ONERA – DLR Aerospace Symposium, ODAS 2023

PEER-REVIEWED PUBLICATIONS

"Powering aircraft with 100% sustainable aviation fuel reduces ice crystals in contrails", ***Atmos. Chem. Phys. 24.6 (2024): 3813-3837***

R. Märkl, C. Voigt, D. Sauer, R. K. Dischl, S. Kaufmann, T. Harlaß, V. Hahn, A. Roiger, C. Weiß-Rehm, U. Burkhardt, U. Schumann, A. Marsing, M. Scheibe, A. Dörnbrack, C. Renard, M. Gauthier, P. Swann, P. Madden, D. Luff, R. Sallinen, T. Schripp, P. Le Clercq

„Measurements of particle emissions of an A350-941 burning 100 % sustainable aviation fuels in cruise", Atmos. Chem. Phys. 24.19 (2024): 11255-11273

R. Dischl, D. Sauer, C. Voigt, T. Harlaß, F. Sakellariou, R. Märkl, U. Schumann, M. Scheibe, S. Kaufmann, A. Roiger, A. Dörnbrack, C. Renard, M. Gauthier, P. Swann, P. Madden, D. Luff, M. Johnson, D. Ahrens, R. Sallinen, T. Schripp, G. Eckel, U. Bauder, P. Le Clercq

"Measurement report: in-flight and ground-based measurements of nitrogen oxide emissions from latest-generation jet engines and 100% sustainable aviation fuel", Atmos. Chem. Phys. 24.20 (2024): 11807-11822

T. Harlass, R. Dischl, S. Kaufmann, R. Märkl, D. Sauer, M. Scheibe, P. Stock, T. Bräuer, A Dörnbrack,

A. Roiger, H. Schlager, U. Schumann, M. Pühl, T. Schripp, T. Grein, L. Bondorf, C. Renard, M. Gauthier, M. Johnson, D. Luff, P. Madden, P. Swann, D. Ahrens, R. Sallinen, C. Voigt

"Comparing the backfilling of mesoporous titania thin films with hole conductors of different size sharing the same mass density", *IUCrJ 7.2 (2020): 268-275*
R. Märkl, N. Hohn, E.Hupf, L. Bießmann, V. Körstgens, L. Kreuzer, G. Mangiapia, M. Pomm. A. Kriele, E. Rivard, P. Müller-Buschbaum

"Phase Transition Kinetics of Doubly Thermo-responsive Poly(sulfobetaine)-based Diblock Copolymer Thin Films", *Macromolecules 53.8 (2020): 2841-2855*
L. Kreuzer, T. Widmann, L. Bießmann, N. Hohn, J. Pantle, R. Märkl, J-F. Moulin, V. Hildebrand, A. Laschewsky, C. Papadakis, P. Müller-Buschbaum

CONFERENCE PRESENTATIONS

Talks/Conference Papers

AGU Annual Meeting 2024 (talk) Washington, D.C. 12/2024
Maerkl, R., Voigt, C., Sauer, D., Dischl, R., Kaufmann, S., Harlaß, T., Scheibe, M., Marsing, A., Bräuer, T., Roiger, A., Seeliger, K., Renard, C., Moreau, J., Greslin, E.: Ice Particle Numbers in Contrails from Lean-Burn Aircraft Engines

23rd ONERA – DLR Aerospace Symposium, ODAS 2023 (talk and conference paper) Paris 06/2023
Maerkl, R., Voigt, C., Sauer, D., Dischl, R., Kaufmann, S., Harlaß, T., Scheibe, M., Marsing, A., Hahn, V., Bräuer, T., Roiger, A., Jurkat-Witschas, T., Dörnbrack, A., Delhaye D., Ortega, I., Seeliger, K., Renard, C., Moreau, J., Le Chenadec, G., Requena-Esteban, E., Basset O.: Inflight measurements of contrail ice crystals of Airbus aircraft with lean-burn engine technology

DLRK 2023 – German Aerospace Congress (talk) Stuttgart 09/2023
Märkl, R., Voigt, C., Sauer, D., Dischl, R., Kaufmann, S., Harlaß, T., Scheibe, M., Marsing, A., Hahn, V., Bräuer, T., Roiger, A., Schmidt, J., Jurkat-Witschas, T., Dörnbrack, A., Horst, E., Seeliger, K., Renard, C., Moreau, J., Le Chenadec, G., Requena-Esteban, E., Corugedo-Bermejo, J.-A., Bethencourt, M., Delhaye, D., Ortega, I., Basset, O., Greslin, E.: Inflight Contrail Ice Crystal Measurements of Airbus Aircraft Equipped with Lean Burn Engines and Burning Sustainable Aviation Fuels

Posters

789. WE-Heraeus-Seminar Bad Honnef 05/2023
Märkl, R., Voigt, C., Sauer, D., Dischl, R., Kaufmann, S., Harlaß, T., Scheibe, M., Marsing, A., Hahn, V., Bräuer, T., Roiger, A., Renard, C., Kulathasan, A., Gass, F., Le Chenadec, G., Requena-Esteban, E., Gauthier, M., Madden, P., Swann, P., Johnson, M., Hayes, D., Le Clercq, P., Sallinen, R. and the ECLIF 3 team: Contrail ice crystal reductions of large passenger aircraft burning 100% sustainable aviation fuel

DPG Spring Meeting Regensburg 2019 Regensburg, 04/2019
Märkl R., Hohn, N., Hupf, E., Mangiapia, G., Pomm, E., Rivard, E., Müller-Buschbaum P.: Mesoporous Titania Backfilled with Heavy Element Containing Small Molecules and High-Efficiency Polymer PTB7-Th for Hybrid Photovoltaics

SNI 2018 Garching Garching, 09/2019
Märkl, R., Hohn, N., Mangiapia, G., Pomm, M., Müller-Buschbaum, P.: Backfilling of Mesoporous Titania Structures with Heavy Element Containing Small Molecules and High-Efficiency Polymer PTB7-Th

8th Colloquium of the MSE: "Advances in Energy Transition" Garching, 07/2019
Märkl, R., Hohn, N., Müller-Buschbaum, P.: Next Generation Hybrid Solar Cells Based on Heavy Element Containing Small Molecules and High-Performance Polymer PTB7-Th

PROFESSIONAL EXPERIENCE

Junior Associate at strategy consultant firm Munich Strategy GmbH & Co. KG 10/2019 – 04/2020
- Assisted consulting work in corporate strategy and mergers and acquisitions (M&A) projects
- Prepared and executed client workshops
- Researched and analyzed markets, competitors, and internal company data within the projects

Technical Translator for European patent applications 01/2015 – 01/2019
- Conducted translations of technical texts (patent applications) and literary texts
- Managed several clients in self-employed operation

SKILLS

- Native speaker of German and English, intermediate proficiency in Portuguese (reading), basics in Spanish, and Advanced Latinum Qualification for the Latin language
- Proficient in statistical data analysis (Python, OriginLab Pro) of experimental data
- Calibration, maintenance, aircraft implementation and operation of in-situ ice particle instrumentation