

Michael Mathias Schulreich

Curriculum Vitæ

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📄 Michael-Schulreich



Profile

Michael Schulreich is a computational astrophysicist with over 15 years of experience in fluid dynamics in astrophysical environments, high-energy astrophysics, and the physics of the interstellar and intergalactic medium. His research focuses on the formation and evolution of interstellar bubbles and superbubbles—such as the Local Bubble and the *eROSITA* bubbles—as well as high-velocity clouds and cosmic bow shocks, using advanced numerical simulations and semi-analytical modeling techniques. He has made significant contributions to understanding the connection between nearby supernova activity and radioisotopic anomalies on Earth (e.g., ^{60}Fe), and their implications for the dynamical and chemical evolution of the local Galaxy. Schulreich has published and co-authored ten scientific papers, including a landmark paper in *Nature*, with additional manuscripts currently in submission and preparation. He is a frequent speaker at international conferences and has delivered numerous invited talks, including plenary presentations. Alongside his research, he teaches extensively, mentors graduate students, and actively engages in science outreach.

Career

- since 05/2025 **Guest scientist**, Zentrum für Astronomie und Astrophysik (ZAA), Technische Universität (TU) Berlin, Germany
- 12/2015–05/2025 **Postdoctoral researcher and lecturer**, ZAA, TU Berlin, Germany
- 01/2009–07/2012 **Research assistant**, ZAA, TU Berlin, Germany

Education

- 11/2015 **Ph.D. Physics**, TU Berlin, Germany, *summa cum laude*
Thesis: *Numerical Investigations on the Link between the ^{60}Fe Anomaly in a Deep-Sea Ferromanganese Crust and the Formation of the Local Bubble*
- 10/2008 **Master Astronomy**, University of Vienna, Austria, with distinction (and maximum GPA)
Thesis: *Plasma Physical Processes and Formation of Structures in Groups and Clusters of Galaxies*
- 02/2007 **Alternative civilian service**, Documentation Centre of Austrian Resistance (DÖW), Vienna, Austria
- 08/2006 **Bachelor Astronomy**, University of Vienna, Austria, with distinction
Thesis: *About Interstellar Magnetic Fields, their Properties and their Formation through the Galactic Dynamo*
- 06/2003 **General university entrance qualification (Matura)**, Bertha-von-Suttner-Gymnasium—Schulschiff, Vienna, Austria, with distinction (and maximum GPA)
Thesis: *The Early Universe—From the Big Bang to the Atom*

Awards and Honors

- 2009 Diploma Award of the Austrian Society of Astronomy and Astrophysics
- 2003–2008 Annual merit-based scholarship of the University of Vienna for exceptional performance during undergraduate and diploma studies

Grants and Funding

- 2021–2025 Contributing researcher in the DFG/ANR-funded Franco-German project: CRitiLISM—Cosmic Rays in the Immediate Local Interstellar Medium; coordinated by S. Gabici (APC Paris), P. Mertsch (RWTH Aachen), and D. Breitschwerdt (TU Berlin)
- Responsible for modeling and analysis within Work Package B (The Local Bubble), focusing on the role of local interstellar structures in cosmic-ray propagation

Teaching Record

- 04/2025–07/2025 **Lecture: Astrophysical Fluid Mechanics, TU Berlin, Germany**
(with M. Pacicco)
- 10/2024–02/2025 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
- 04/2024–07/2024 **Lecture: Physics of the Interstellar and Intergalactic Medium, TU Berlin, Germany**
Lecture: Astrophysical Fluid Mechanics, TU Berlin, Germany
- 10/2023–02/2024 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
Lecture in series: Modern Methods in Physical Research, TU Berlin, Germany
- 04/2023–07/2023 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
- 10/2022–02/2023 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
Lecture in series: Modern Methods in Physical Research, TU Berlin, Germany
Seminar: The Cosmic Matter Cycle—Current Research Topics, TU Berlin, Germany
(with D. Breitschwerdt)
- 04/2022–07/2022 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
- 10/2021–02/2022 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
Lecture in series: Modern Methods in Physical Research, TU Berlin, Germany
Seminar: The Cosmic Matter Cycle—Current Research Topics, TU Berlin, Germany
(with D. Breitschwerdt)
- 04/2021–07/2021 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
- 10/2020–02/2021 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
Lecture in series: Modern Methods in Physical Research, TU Berlin, Germany
Seminar: The Cosmic Matter Cycle—Current Research Topics, TU Berlin, Germany
(with D. Breitschwerdt)
- 04/2020–07/2020 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
Seminar: The Cosmic Matter Cycle—Current Research Topics, TU Berlin, Germany
(with D. Breitschwerdt)
- 10/2019–02/2020 **Lecture: Physics of the Interstellar and Intergalactic Medium, TU Berlin, Germany**
Lecture: Astrophysical Fluid Mechanics, TU Berlin, Germany
- 04/2019–07/2019 **Lab course: Numerical Methods in Astrophysics, TU Berlin, Germany**
Seminar: The Cosmic Matter Cycle—Current Research Topics, TU Berlin, Germany
(with D. Breitschwerdt)

- 04/2018–07/2018 **Seminar: The Cosmic Matter Cycle—Current Research Topics**, *TU Berlin*, Germany (with D. Breitschwerdt)
- 04/2017–07/2017 **Lecture: Astrophysical Fluid Mechanics**, *TU Berlin*, Germany
Seminar: The Cosmic Matter Cycle—Current Research Topics, *TU Berlin*, Germany (with D. Breitschwerdt)
- 04/2012–07/2012 **Seminar: High-Energy Astrophysics**, *TU Berlin*, Germany (with D. Breitschwerdt)
- 10/2011–02/2012 **Seminar: The Cosmic Matter Cycle—Current Research Topics**, *TU Berlin*, Germany (with D. Breitschwerdt)
- 04/2011–07/2011 **Seminar: The Cosmic Matter Cycle—Current Research Topics**, *TU Berlin*, Germany (with D. Breitschwerdt)
- 10/2010–02/2011 **Seminar: Dark Energy—The Dark Side of the Universe**, *TU Berlin*, Germany (with D. Breitschwerdt)
- 04/2010–07/2010 **Seminar: Star Formation**, *TU Berlin*, Germany (with D. Breitschwerdt)
- 10/2009–02/2010 **Seminar: Galaxy Evolution**, *TU Berlin*, Germany (with D. Breitschwerdt)
- 04/2009–07/2009 **Seminar: Radiation Processes in Physics and Astronomy**, *TU Berlin*, Germany (with D. Breitschwerdt)

Publications

h-index: **6** ■ Total citations: **217** (SAO/NASA ADS)

- [11] Scheffler, T., **Schulreich, M. M.**, Schurer, D. P. P. R. & Breitschwerdt, D. Tidal disruption events as the origin of the eROSITA and Fermi bubbles. *Astron. Astrophys.* **695**, A34 (2025)
- [10] Siegert, T., **Schulreich, M. M.**, Bauer, N., Reinhardt, R., Mittal, S. & Yoneda, H. Gamma-ray line emission from the Local Bubble. *Astron. Astrophys.* **689**, A2 (2024)
- [9] **Schulreich, M. M.**, Feige, J. & Breitschwerdt, D. Numerical studies on the link between radioisotopic signatures on Earth and the formation of the Local Bubble. II. Advanced modelling of interstellar ^{26}Al , ^{53}Mn , ^{60}Fe , and ^{244}Pu influxes as traces of past supernova activity in the solar neighbourhood. *Astron. Astrophys.* **680**, A39 (2023)
- [8] **Schulreich, M. M.** & Breitschwerdt, D. The time-dependent Rayleigh-Taylor instability in interstellar shells and supershells, including the eROSITA bubbles. *Mon. Not. R. Astron. Soc.* **509**, 716–737 (2022)
- [7] Fields, B., Ellis, J. R., Binns, W. R., Breitschwerdt, D., deNolfo, G. A., Diehl, R., Dwarkadas, V. V., Ertel, A., Faestermann, T., Feige, J., Fitoussi, C., Frisch P., Graham, D., Haley, B., Heger, A., Hillebrandt, W., Israel, M. H., Janka, T., Kachelrieß, M., Korschinek, G., Limongi, M., Lugaro, M., Marinho, F., Melott, A., Mewaldt, R. A., Miller, J., Ogliore, R. C., Paul, M., Paulucci, L., Pecaut, M., Rauch, B. F., Rehm, K. E., **Schulreich, M. M.**, Seitenzahl, I., Sørensen, M., Thielemann, F.-K., Timmes, F. X., Thomas, B. C. & Wallner, A. Near-Earth Supernova Explosions: Evidence, Implications, and Opportunities. *Bull. Am. Astron. Soc.* **51**, 410 (2019)
- [6] **Schulreich, M. M.**, Breitschwerdt, D., Feige, J. & Dettbarn, C. A Way Out of the Bubble Trouble?—Upon Reconstructing the Origin of the Local Bubble and Loop I via Radioisotopic Signatures on Earth. *Galaxies* **6**, 26 (2018)

- [5] **Schulreich, M. M.**, Breitschwerdt, D., Feige, J. & Dettbarn, C. Numerical studies on the link between radioisotopic signatures on Earth and the formation of the Local Bubble. I. ^{60}Fe transport to the solar system by turbulent mixing of ejecta from nearby supernovae into a locally homogeneous interstellar medium. *Astron. Astrophys.* **604**, A81 (2017)
- [4] Feige, J., Breitschwerdt, D., Wallner, A., **Schulreich, M. M.**, Kinoshita, N., Paul, M., Dettbarn, C., Fifield, L. K., Golser, R., Honda, M., Linnemann, U., Matsuzaki, H., Merchel, S., Rugel, G., Steier, P., Tims, S. G., Winkler, S. R. & Yamagata, T. The Link Between the Local Bubble and Radioisotopic Signatures on Earth. *JPS Conf. Proc.* **14**, 010304 (2017)
- [3] Breitschwerdt, D., Feige, J., **Schulreich, M. M.**, de Avillez, M. A., Dettbarn, C. & Fuchs, B. The locations of recent supernovae near the Sun from modelling ^{60}Fe transport. *Nature* **532**, 73–76 (2016)
- [2] **Schulreich, M. M.** *Numerical investigations on the link between the ^{60}Fe anomaly in a deep-sea ferromanganese crust and the formation of the Local Bubble.* PhD thesis, Technische Universität Berlin, Germany (2015)
- [1] **Schulreich, M. M.** & Breitschwerdt, D. Astrophysical bow shocks: an analytical solution for the hypersonic blunt body problem in the intergalactic medium. *Astron. Astrophys.* **531**, A13 (2011)

Academic Presentations

Invited Talks

- 2025 DAWN Cake Talks, Copenhagen, Denmark (6 Mar)
- 2023 Online seminar of IAU Commission H1: The Local Universe (18 Oct)
Workshop: Supernova Remnants in Complex Environments, Leiden, Netherlands (9–13 Oct)
96th Annual Meeting of the German Astronomical Society, Berlin, Germany (11–15 Sep, Plenary)
Seminar of the Interstellar Medium* Group, Space Telescope Science Institute, Baltimore, USA (9 Mar)
- 2018 Workshop: Searching for the Sources of Galactic Cosmic Rays, Paris, France (11–14 Dec)
Seminar at the Erlangen Centre for Astroparticle Physics, Erlangen, Germany (6 Jun)
Workshop: Astrophysical Shocks, Potsdam, Germany (5–7 Mar)
- 2017 Workshop: Three Elephants in the Gamma-Ray Sky—Loop I, the Fermi Bubbles, and the Galactic Center Excess, Garmisch-Partenkirchen, Germany (21–24 Oct)
- 2016 Workshop: Sources of Galactic Cosmic Rays, Paris, France (7–9 Dec)
- 2014 Workshop: Superbubbles, HI Holes and Supershells, Freising, Germany (10–12 Nov)
- 2009 Joint Annual Meeting of the Swiss Physical Society, Austrian Physical Society, and Austrian Society for Astronomy and Astrophysics, Innsbruck, Austria (2–4 Sep, Diploma Award)

Contributed Talks

- 2024 European Astronomical Society Annual Meeting, Padova, Italy (1–5 Jul)
19th Russbach School on Nuclear Astrophysics, Russbach, Austria (3–9 Mar)
- 2020 93rd Annual Meeting of the German Astronomical Society, Online (21–25 Sep)
- 2017 Workshop: Physics of the Interstellar Medium, Berlin, Germany (25 Jan)
- 2016 89th Annual Meeting of the German Astronomical Society, Bochum, Germany (12–16 Sep)

- Conference: Supernova Remnants—An Odyssey in Space After Stellar Death, Chania, Crete, Greece (6–11 Jun)
- 2015 4th Potsdam–Berlin Astronomical Colloquium, Potsdam, Germany (20 Feb)
- 2014 78th Annual Meeting of the German Physical Society and German Physical Society Spring Meeting, Berlin, Germany (17–21 Mar)
- 2013 527th WE Heraeus Seminar: Plasma and Radiation Environment in Astrospheres and Implications for the Habitability of Extrasolar Planets, Bad Honnef, Germany (10–15 Mar)
German Physical Society Spring Meeting, Jena, Germany (25 Feb–1 Mar)
- 2012 85th Annual Meeting of the German Astronomical Society, Hamburg, Germany (24–28 Sep)
Workshop: Hot Plasmas in Laboratory and Space, Berlin, Germany (21 Sep)
- 2009 82nd Annual Meeting of the German Astronomical Society, Potsdam, Germany (21–25 Sep)

Poster Presentations

- 2013 86th Annual Meeting of the German Astronomical Society, Tübingen, Germany (24–27 Sep)
- 2011 84th Annual Meeting of the German Astronomical Society, Heidelberg, Germany (19–23 Sep, Two Posters)

Public Talks

- 2024 The Long Night of Science 2024, Berlin, Germany (22 Jun)
37th University Days of Physics—New Findings in Astronomy, Marburg, Germany (15–16 Feb)

Professional Development

- 2023 Challenges and Innovations in Computational Astrophysics V, Online (7–9 Nov)
- 2022 Challenges and Innovations in Computational Astrophysics IV, Online (21–23 Nov)
Introduction to GPU Programming using CUDA, Online (14–17 Nov)
The Researcher as a Brand—Self-Marketing for Scientists, Berlin (24–25 Jan)
- 2021 Applying with the Unique Soft Skills of Your STEM Profile, Berlin (1 Dec)
International Summer School on the Interstellar Medium of Galaxies—From the Epoch of Reionization to the Milky Way, Online (12–23 Jul)
- 2017 International Symposium on Trends in Big Data, Berlin, Germany (29 Jun)
Gaia Data Workshop, Berlin, Germany (2–3 Mar)
- 2016 Virtual Observatory Workshop, Berlin, Germany (28 Jun)
OpenMP and OpenACC GPU Directives for Parallel Accelerated Supercomputers—An Alternative to CUDA from Cray Perspective, Stuttgart, Germany (17–18 Mar)
- 2010 AstroSim Summer School on Computational Astrophysics, Toruń, Poland (12–23 Jul)
Introduction to Computational Fluid Dynamics, Stuttgart, Germany (15–19 Mar)
Postgraduate School on MHD Dynamos in Laboratory and Astrophysical Plasmas, Bochum, Germany (15–19 Feb)
Parallel Programming Workshop (MPI and OpenMP), Jülich, Germany (11–13 Jan)
- 2008 Joint European and National Astronomy Meeting (JENAM) 2008, Vienna, Austria (8–12 Sep)

Supervision and Mentoring

Ph.D. Theses

since 2023 Mattia Pacicco (TU Berlin): *MHD simulations of supernova remnants and superbubbles* (working title)

Master's Theses

since 2024 Emre Elmalı (TU Berlin): *Reconstructing the progenitor stars of the Orion-Eridanus superbubble* (working title)

2023 Tassilo Scheffler (FU Berlin): *Hydrodynamical simulations on the origin and evolution of the eROSITA bubbles*

2021 Frederik Berberich (HU Berlin): *Numerical studies on the magnetic field structure in the vicinity of superbubbles and the impact of the magnetic field on their dynamical evolution*

Bachelor's Theses

2024 David P. P. R. Schurer (TU Berlin): *X-ray maps from hydrodynamic simulations on the origin of the eROSITA bubbles*

2021 Sebastian Wullrich (FU Berlin): *Numerical calculations of superbubbles according to Kompaneets' approximation*

2019 Jakob Neef (FU Berlin): *Hydromagnetic astrophysical bow shocks*

Philip Knospe (TU Berlin): *Analytical solutions of the blunt body problem in the context of stellar bow shocks*

Conference Organization

2023 Member of the Local Organizing Committee, 96th Annual Meeting of the German Astronomical Society, Berlin (11–15 Sep)

2020 Organization of the splinter meeting: *Confronting Simulations of the Interstellar Medium with Observations and Measurements*, 93rd Annual Meeting of the German Astronomical Society (with D. Breitschwerdt), Online (23–24 Sep)

Professional Service

since 2008 Referee for peer-reviewed journals, including *The Astrophysical Journal*, *Monthly Notices of the Royal Astronomical Society*, and *Astrophysics and Space Science*

Public Engagement

2016–2025 Responsible for managing public inquiry emails and maintaining the outreach contact list at the Institute for Physics and Astronomy, TU Berlin

2009–2025 Active involvement in outreach events at TU Berlin (Long Nights of Science, Girls' Days, Pupil Info Days, career fairs, etc.)

10/2005 Collaboration at the Open Day of the Vienna University Observatory

Professional Memberships

since 2022 International Astronomical Union (IAU)

since 2019 European Astronomical Society (EAS)

since 2008 Astronomische Gesellschaft (AG)

Technical Skills

Programming languages	Fortran, Python, C	Symbolic mathematics	Mathematica, Derive
Parallel programming	MPI, OpenMP, OpenACC	Graphics design	Affinity Creative Suite
Data visualization	yt, Vapor, ParaView, VisIt, Gnuplot		

Languages

German	Native speaker
English	Fluent (professional level)
Latin	Reading knowledge

References

- **Prof. Dr. Dieter Breitschwerdt**
Professor of Theoretical Astrophysics
ZAA, TU Berlin
breitschwerdt@astro.physik.tu-berlin.de
- **Dr. Jenny Feige**
Research Scientist
Museum für Naturkunde – Leibniz Institute for Evolution and Biodiversity Science, Berlin
jenny.feige@mfng.berlin
- **Dr. Thomas Siebert**
Junior Research Group Leader
Institute for Theoretical Physics and Astrophysics, University of Würzburg
thomas.siebert@uni-wuerzburg.de
- **Priv.-Doz. Dr. Jürgen Kerp**
Senior Scientist
Argelander Institute for Astronomy, University of Bonn
jkerp@uni-bonn.de