CV - Christian Möstl

Head, Austrian Space Weather Office, GeoSphere Austria
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Personal Information

Mag. Dr. Christian Möstl Nationality: Austrian PhD: 2009, Univ. of Graz, Austria Children: 1

Main areas of research

I am a space scientist based in Graz, Austria and work on basic heliophysics research and applied heliospheric weather forecasting - think of meteorology, but in space. I study the interplanetary evolution, 3D structure and global shape of solar storms (coronal mass ejections, CMEs) with multi-platform in situ and imaging observations by SDO, SOHO, STEREO, Wind, ACE, Venus Express, MESSENGER, MAVEN, Parker Solar Probe, Solar Orbiter and BepiColombo with empirical, analytical and numerical modeling. I am managing the most comprehensive living catalog on CMEs observed in situ at https://helioforecast.space/icmecat. I played a large part in developing the new field of interpreting and modeling heliospheric imager observations (provided by STEREO, Solar Orbiter, Parker Solar Probe, or the future ESA Vigil mission to the L5 point), and I invented a new 3D CME flux rope model (3DCORE). Further, I work on algorithms for the real time prediction of the solar wind, the aurora and geomagnetically induced currents including machine learning, and I have been involved in studies of space weather on exoplanets. In 2022, I received an ERC Consolidator Grant and in 2016 the Arne Richter Award, the highest honor for young researchers by the EGU.

Leadership

1. PI of **5 completed and 1 ongoing** research project (3 EU, 3 Austrian Science Fund FWF).
   ERC Consolidator Grant 2021 (PE9, Universe Sciences, project HELIO4CAST) 2022 - 2027.
   Total PI budget: **3.6 Mio €.** Proposal advisor for 2 successful ERC CoG grants (1 Austria, 1 Finland).
2. Founder of the **Austrian Space Weather Office** (2022-), where I lead a team of 9 researchers, see https://helioforecast.space/team. Lead and co-lead of the Solar Orbiter science working group „Eruptive Events and Large-Scale Structure“ with 200+ participants (since 2020).
3. Convener and co-convener of **8 sessions at international conferences**, working group leader at 2 international conferences, organizer of 1 workshop in Austria, 7 invited talks. Member of the SOC at 2024 COSPAR session "Off-the-Sun-Earth-Line (OSEL) missions”.

Experience abroad

Space Science Laboratory, University of California, Berkeley (employed there for 1 year, 2011-2012), University of New Hampshire, (3 visits, 2006-2009, 3 months), NASA Jet Propulsion Laboratory, Pasadena (2 visits, 2012, 2 weeks). Seminars e.g. at ROB Belgium, Imperial College, NYU Abu Dhabi.

Current position

2022 - : Head and founder of the Austrian Space Weather Office at the GeoSphere Austria, PI of ERC Consolidator Grant HELIO4CAST, in Graz, Austria.

Former positions

2020 - 2022: Research Associate & project PI, Space Research Institute (IWF), Austrian Academy of Sciences, **leading 2 Austrian Science Fund (FWF) projects**: *Modeling the magnetic cores of solar storms and* P31521-N27, *Enhanced lead time for geomagnetic storms,* P31659-N27.

2020: Research Associate & project PI, Technical University of Graz, Institute for Geodesy, leading 2 FWF projects: *Modeling the magnetic cores of solar storms*, P31521-N27, *Enhanced lead time for geomagnetic storms,* P31659-N27.

2014 - 2020: Research Associate & project PI, Space Research Institute (IWF), project: *The evolution of solar storms in the inner heliosphere,* Austrian Science Fund, P26174-N27.

2014 - 2017: Working package leader & local PI, Institute of Physics, University of Graz (UNI Graz), Austria. *HELCATS - Heliospheric Cataloguing Analysis and Techniques Service,* EU-FP7-SPACE.

2013 - 2014: Post-Doc, Institute of Physics, UNI Graz, Austria. *COMESEP - Coronal mass ejections and solar energetic particles,* EU FP7 - SPACE, PI: N. Crosby.

2012 - 2013: Marie Curie Fellow (Post-Doc), Institute of Physics, UNI Graz, Austria. *WILISCME: The relationship between white-light and in situ observations of coronal mass ejections,* Marie-Curie international outgoing fellowship (return phase), EU FP7 - PEOPLE, PI: C. Möstl

2011 - 2012: Marie Curie Fellow (Post-Doc), **Space Science Laboratory, University of California, Berkeley, USA,** *WILISCME,* Marie-Curie international outgoing fellowship, EU FP7 - PEOPLE, PI: C. Möstl, supervisor: J. G. Luhmann.

2011: Post-Doc, Institute of Physics, UNI Graz, Austria, project: *COMESEP - Coronal mass ejections and solar energetic particles,* EU FP7 - SPACE, PI: N. Crosby.

2010 - 2011: Post-Doc, IWF, Graz, Austria, *Magnetic clouds and their solar sources,* Austrian Science Fund, PI: H. Biernat. **2008 - 2009:** Doctoral Researcher, IWF, Graz, Austria, *Magnetic clouds and their solar sources,* Austrian Science Fund, PI: H. Biernat. **2007 - 2008:** Doctoral Researcher, IWF, Graz, Austria, *Multi-spacecraft studies of magnetic clouds*, funded by University of Graz, PI: C. Möstl.

Supervised young researchers (and their current position): M. A. Reiss (NASA, permanently), T. Amerstorfer (research project PI, GeoSphere Austria, permanent), R. L. Bailey (GeoSphere Austria, permanent), A. J. Weiss (PostDoc, NASA Goddard), U. V. Amerstorfer (PostDoc, GeoSphere), E. E. Davies (PostDoc, GeoSphere), H. T. Rüdisser (PhD student, GeoSphere), M. Bauer (PhD student, Geosphere), E. Weiler (PhD student, GeoSphere), M. Dumbovic (research project PI, Univ. of Zagreb), M. Kubicka (TU Graz), J. Donnerer, P. Boakes, O. Törmanen, D. Utz (all industry).

Academic education: 2006-2009: PhD Study in natural sciences (physics, with distinction) at the UNI Graz, Thesis: *Modeling of magnetic clouds using multi-spacecraft observations*, supervisors: Helfried Biernat, Charles J. Farrugia (University of New Hampshire, USA). **1999-2005**: Study of physics at the UNI Graz, with distinction, master thesis supervisor: Arnold Hanslmeier.

Publications

116 articles (16 as first author) in **internationally peer-reviewed scientific journals**, such as *Nature Communications, Astrophysical Journal Letters*, *Geophysical Research Letters,* etc.
h-index: 40, total citations: 4798, source: SAO/NASA ADS, April 2024.

Conferences

> 200 posters and talks (author and co-author) at AGU, EGU, COSPAR, IUGG, SIP, ICS9, SOHO, and STEREO meetings.

Seminar talks at Lockheed Martin Solar and Astrophysics Laboratory, CA, USA; NASA/Caltech Jet Propulsion Laboratory, CA, USA; Imperial College, UK; NY University, Abu Dhabi.

Convener and Co-Convener of 9 sessions at international conferences (3 AGU, 3 EGU, 1 SHINE, ISEST workshop, 7th SIP workshop). Organizer of a CME workshop in Austria.

Invited talks (7 in total)

1. *Lectures from multipoint observations of ICMEs*, at The Sun 360, Kiel, Germany, 2011.
2. *Connecting directions, speeds and arrival times of 22 CMEs from the Sun to 1 AU,* at the European Geosciences Union (EGU) General Assembly, Vienna, 2014.
3. *Combining Heliospheric Imaging and in situ observations to constrain CME evolution,* 7th Solar Image Processing workshop, La Roche-en-Ardenne, Belgium, 2014.
4. *A new view of solar coronal mass ejections with the Heliophysics System Observatory*, EGU Vienna, 2016.
5. *Predicting CME arrivals and their planetary impacts: a review of methods and results*, ESPM-15 Budapest, 2017.
6. *The heliosphere in 3D from multi-spacecraft observations*, IAUS 372, (virtual), 2022.
7. *On the current understanding of large-scale flux ropes within solar coronal mass ejections*, EGU, Vienna, 2024.

Most important academic awards

1. **Arne Richter Award for Outstanding Young Scientists of the European Geosciences Union**. Open world-wide, 4 recipients each year in the geo-, space and solar system sciences. (2016)
2. **Josef - Krainer Award** for young researchers (federal state of Styria, Austria, 2011).
3. Award of the governor of Styria for young researchers (UNI Graz, 2008).
4. Young Scientist Outstanding Poster Presentation Award (European Geophysical Union, 2008).

Further recognitions: PRO SCIENTIA scholarship for interdisciplinary communication (Austria, 2008, 2009), Alumni of the month at the University of Graz (2016).

Most important peer review activities

1. Reviewer for NASA (ROSES, 2x), NSF (SHINE), USA. Czech Science Foundation, Swiss National Science Foundation, AXA research fund.
2. Reviewer for the international journals: *Nature*, *The Astrophysical Journal, The Astrophysical Journal Letters, Journal of Geophysical Research, Geophysical Research Letters, Solar Physics, Annales Geophysicae, Journal of Space Weather and Space Climate, JASTP, Physics of Plasmas.*
3. Pre-Examiner of the PhD thesis of Alexey Isavnin, University of Helsinki, Finland (2014).
4. Student judge at AGU and EGU meetings.

Most important memberships in academic organizations

1. Member (2012-2014) of the Scientific Organizing Committee of the Varsiti/ISEST program.

All research projects

Total research budget as PI: 3.6 Mio. €

1. *HELIO4CAST - Solving the Bz problem in heliospheric weather forecasting,* ERC Consolidator Grant 2021, duration: 2022-2027, budget: 2 Mio. €.
2. *Enhanced lead time for geomagnetic storms*, Austrian Science Fund - stand alone project, duration: 2019-2023, budget: 376k €.
3. *Modeling the magnetic cores of solar storms*, Austrian Science Fund - stand alone project, duration: 2019-2022, budget: 353k €.
4. *The evolution of solar storms in the inner heliosphere,* Austrian Science Fund - stand alone project, duration: 2014-2019, budget: 447k €.
5. *HELCATS – Heliospheric Cataloguing, Analysis and Techniques,* EU FP7 - SPACE, 2014-2017,

local PI with budget of 270k € (full budget: 2.5 Mio €, PI R. Harrison). https://www.helcats-fp7.eu
6. *WILISCME - The relationship between white-light and in situ observations of coronal mass ejections* Marie-Curie fellowship, European Union FP7-PEOPLE IOF, 2011-2013, 146k €.

Key international collaboration partners in the last 5 years

J. A. Davies, R. A. Harrison, Methods for predicting CMEs with Heliospheric Imagers, STEREO data analysis, RAL Space, UK; T. Horbury, Solar Orbiter magnetometer, Imperial College, UK; D. Heyner, BepiColombo magnetometer, TU Braunschweig, Germany; C. J. Farrugia, N. Lugaz, Interplanetary small satellites, CME modeling, University of New Hampshire, USA. E. Palmerio, P. Riley, magnetic structure of ICMEs, Predictive Science, San Diego, USA.

Public outreach

Interviews and articles in the Austrian national television, press and radio (e.g. ORF Zeit im Bild, Die Presse, Kurier, derStandard, orf.at, Kleine Zeitung, Terra Mater, Ö1, Ö3, Antenne, derPragmaticus), and international press (e.g. Australian Cosmos magazine, in the USA space.com, Popular Science magazine). I was an expert adviser for the Austrian mint for a coin about extraterrestrial life (which won a an award as best bi-metallic coin in 2023), and was a young science ambassador in Austria (2020-2022), visiting schools to spark the interest in science for school children. I am a strong advocate of open science and diversity in science teams. I have 3.6k followers on https://twitter.com/chrisoutofspace where I comment on heliophysics and space weather, and on https://twitter.com/ASWOGeoSphere our team publishes real-time predictions of the solar wind, solar storms and the aurora for people from all over the world.