Dariusz A. Wójcik

Ph.D.

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Profile

Applied Mathematician and early-career Space Physicist with expertise in turbulence, stochastic processes, probability theory, and space data analysis. Experienced in working with the NASA's *Magnetospheric Multiscale* (*MMS*) mission satellite data, statistical modeling, numerical analysis, and interdisciplinary research bridging mathematics and space physics, as well as finances and insurances. Proficient in applying advanced mathematical frameworks such as *Markov processes*, *Fokker–Planck* and *Langevin* dynamics, and *fractal* analysis to investigate energy transfer mechanisms in space plasma turbulence across kinetic scales. Author and co-author of various peer-reviewed publications in leading physical and astrophysical journals.

Education

Mar 2022 – Sep 2025 **Ph.D. in Space Physics (Exact and Natural Sciences)**, *Space Research Centre, Polish Academy of Sciences*, Warsaw, Poland
Thesis: *Analysis of Markov Processes in Space Environment*. With Honors (***Cum Laude***).

Oct 2019 – Jan 2022 **M.Sc. in Mathematics (Insurance & Finance)**, *Warsaw University of Technology*, Warsaw, Poland
Thesis: *Cybersecurity Insurance Modeling*. Rector's Scholarship.

Oct 2019 – Dec 2021 **M.Sc. in Mathematics (Economy)**, *Cardinal Stefan Wyszyński University*, Warsaw, Poland
Thesis: *Stability Analysis of the Generalized Lorenz System*. Rector's Scholarship.

Oct 2016 – Jul 2019 **B.Sc. in Mathematics (Finance)**, *Cardinal Stefan Wyszyński University*, Warsaw, Poland
Thesis: *Mathematical Modeling of the Heartbeat*. With Honors (***Cum Laude***), Rector's Scholarship.

Research Positions

Sep 2025 – present **Research Fellow (Space Physicist)**
Space Research Centre, Polish Academy of Sciences, Warsaw, Poland.

Research Interests

Space Plasma; Turbulence; Solar Wind; Magnetosphere; Magnetic Reconnection; Stochastic Processes; Statistical Modeling; Dynamics; Differential Equations; Cybersecurity Modeling; Non-life Insurances.

Publications

Main Peer-Reviewed Papers

Nov 2025 **W. M. Macek and D. Wójcik**, *Multifractal Spectrum Observed in the Universe Distribution of Galaxies* (***In 2nd Review***), Chaos: Galaxy Distribution, #CHA25-AR-01365R.

Oct 2025 **W. M. Macek and D. Wójcik**, *Fractal Nature of Galaxy Clustering in the Updated CfA Redshift Catalog* (***In 3rd Review***), Scientific Reports: Galaxies, https://doi.org/10.13140/RG.2.2.15119.91045.

Sep 2025 **D. Wójcik and W. M. Macek**, *Searching for Universality of Turbulence in the Earth's Magnetosphere*, Journal of Geophysical Research: Space Physics, 130(10), e2025JA034020, https://doi:10.1029/2025JA034020.

Aug 2024 **D. Wójcik and W. M. Macek**, *Testing for Markovian Character of Transfer of Fluctuations in Solar Wind Turbulence on Kinetic Scales*, Physical Review E, 110(2), 025203, https://doi.org/10.1103/PhysRevE.110.025203.

Sep 2023 **W. M. Macek and D. Wójcik**, *Statistical Analysis of Stochastic Magnetic Fluctuations in Space Plasma Based on the MMS Mission*, Monthly Notices of the Royal Astronomical Society, 526(4), 5779–5790, https://doi.org/10.1093/mnras/stad2584.

Feb 2023 **W. M. Macek, D. Wójcik, J. L. Burch**, *Magnetospheric Multiscale Observations of Markov Turbulence on Kinetic Scales*, The Astrophysical Journal, 943(2):152, https://doi.org/10.1029/2025JA034020.

Other Papers

Oct 2025 **R. Ringuette, M. Hughes et al., incl. D. Wójcik**, *Open Science for Missions and Observatories: Practical Choices to Shape Your Observing Adventure* (In Review), https://tinyurl.com/OpenScienceMissions.

Feb 2024 **S. Dorfman, E. Lichko et al., incl. D. Wójcik**, *Next Generation Solar Wind Facility for Discovery Plasma Science*, Fusion Energy Sciences Advisory Committee *White Paper*. https://tinyurl.com/fesac24.

Research Projects

Jan 2022 – Jul 2025 **Turbulence and Magnetic Reconnection in Earth's Space Environment**, *National Science Centre (NCN)*, Kraków, Poland, ***Doctoral Scholarship Holder***
Title: Analysis of high-resolution *MMS* mission data to study turbulence and reconnection in the solar wind and magnetosphere.

Conferences & Presentations

Dec 2025 **American Geophysical Union (AGU) 2025**, New Orleans, LA, USA,
Title: *Markovian Universality and Local Asymmetry of Turbulent Cascades in Earth's Magnetosphere: Multiscale MMS Study*.

Oct 2025 **Cluster – Plasma Observatory 2025 (INVITED)**, Paris, France,
Title: *Universality of Markovian Turbulence in Earth's Magnetosphere Based on MMS Data*.

May 2025 **European Geosciences Union (EGU) 2025**, Vienna, Austria,
Title: *Testing For Universality of Markov Solar Wind Turbulence at the Earth's Magnetosphere on Kinetic Scales Based on the MMS Mission*.

Dec 2024 **American Geophysical Union (AGU) 2024**, Washington DC, USA,
Title: *Multifractal Spectrum Observed in the Distribution of Galaxies*
Title: *MMS Observations of Markov Turbulence in the Magnetosheath on Kinetic Scales*.

May 2024 **EMCEI 2024**, Marrakesh, Morocco,
Title: *Exploring Solar Wind Turbulence: MMS Mission Comparative Data Analysis*.

Apr 2024 **European Geosciences Union (EGU) 2024**, Vienna, Austria,
Title: *Probing Small Scale Solar Wind Turbulence: Markovian Analysis and Scale Interactions from Inertial to Kinetic Regimes*.

Jul 2023 **SigmaPhi Statistical Physics 2023**, Crete, Greece,
Title: *MMS Observations of Kappa Distributions in the Magnetosheath on Small Scales*.

Jun 2023 **CHAOS International Conference 2023**, Crete, Greece,
Title: *Fokker-Planck Statistical Analysis of Turbulence on Kinetic Scales*.

May 2023 **American Geophysical Union (AGU): Chapman - Alfvén Waves 2023**, Berlin, Germany,
Title: *Markov Analysis of Magnetic Turbulence on Kinetic Scales Based on MMS Data*.

Apr 2023 **European Geosciences Union (EGU) 2023**, Vienna, Austria,
Title: *Comparative MMS Analysis of Markov Turbulence in the Magnetosheath on Kinetic Scales*.

Technical Skills

Programming R, Python, SQL, Mathematica, IDL

Tools SPEDAS, PlasmaPy, AstroPy, SpacePy, Git, CDFlib, LaTeX, MatLab

Mathematics Statistics, Probability, Differential Equations, Dynamical Systems

Soft Skills Critical thinking, Problem-solving, Adaptability, Communication, Attention to Detail

Languages

Polish	Native	**English**	Fluent
German	Basic	**Japanese**	Basic

Experience

Aug 2025 **Peer-reviewer** for *Scientific Reports* – Springer Nature, and *Entropy* / *Atmosphere* MDPI articles.

Jan 2023 – Jan 2026 **Member** of the European Geosciences Union (EGU), American Geophysical Union (AGU), and Japan Geoscience Union (JpGU).

Outreach articles

- *Mathematics behind the turbulent space weather: why Markov processes matter for modern technology?* GeoPlanet School CAMK Warsaw.
- *Polish-American team uncovers new details of space turbulence* Science in Poland.
- *The mechanism responsible for magnetic turbulence in space around Earth* Cardinal Stefan Wyszynski University Warsaw.