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Anna Guseva

Education

26/02/2018 **Ph.D. in Engineering**, University of Bremen, Germany
Thesis: "Dynamics and transport of instabilities in magnetized quasi–Keplerian Taylor–Couette flows", supervised by Prof. Marc Avila and funded by German Research Foundation

19/06/2014 **M. Sc. Thermophysics & molecular physics**, National Research University "Moscow Power Engineering Institute", Russia
Thesis: "Nonlinear analysis of the azimuthal magnetorotational instability"

19/06/2012 **B. Sc. Thermophysics**, National Research University "Moscow Power Engineering Institute", Russia, *Thesis*: "Electrovortex flow in hemispherical geometry"

Employment

since 01/07/2023 **Postdoctoral Fellow**, Laboratoire d'Etudes du Rayonnement et de la Matière en Astrophysique et Atmosphères, the Paris Observatory, France
- Numerical and mathematical modelling of stellar magnetohydrodynamics as a part of ANR project PROMETHEE on star formation

01/09/2020 – 30/06/2023 **Marie Curie Research Fellow**, University of Leeds, UK
School of Mathematics
- Data-driven analysis and reduced-order modelling of astrophysical dynamos, in collaboration with Prof. S. Tobias

01/02/2018– 31/07/2020 **Postdoctoral researcher**, Polytechnic University of Madrid, Spain
School of Aeronautics and Space Engineering
- A comprehensive study of interaction between large- and small-scale structures in turbulent flows, in collaboration with Prof. J. Jiménez

01/03/2016 – 31/12/2017 **Research Assistant**, Center of Applied Space Technology and Microgravity, University of Bremen, Germany
- I found the possibility of a fully nonlinear self-sustained dynamo action in quasi-Keplerian accretion disc shear flows

01/08/2014 – 29/02/2016 **Research Assistant**, Institute of Fluid Mechanics, Friedrich-Alexander-University Erlangen-Nürnberg, Germany
- A study of transition to turbulence and momentum transport in magnetized quasi-Keplerian accretion disc flows

Awards

2024 Severo Ochoa Visiting Grant
I was awarded funding to present my recent work on stellar dynamos at the Institute of Astrophysics of Andalusia, Spain (IAA-CSIC) through Severo Ochoa Visitor Program.

2023 Postdoctoral Fellowship of the Paris Observatory
Peer-reviewed independent 2-years project on data-driven modelling of stellar magnetic activity for PLATO mission, with the aim of facilitating detection of exoplanets.

2022 The Observatoire de Paris – PSL Visiting Fellowship
I was awarded this fellowship to continue my research in the field of data-driven modelling of stellar and planetary dynamos, and participated in activities of the Graduate Program in Astrophysics at the Paris Observatory and PSL University.

2020 Marie Sklodowska Curie Individual Fellowship
I was awarded funding for implementation of the research project DynMode under Horizon 2020 Framework Programme. The projected was devoted to modelling of interscale nonlinear interactions in the dynamo flows using the novel data-driven approach.

2017 Kavli Institute for Theoretical Physics (US) Affiliate Visitor Grant
I was invited as an Affiliate Visitor to a program entitled "Recurrent Flows: The Clockwork Behind Turbulence", gathering experimentalists, theorists and computationalists to work on understanding the transition to turbulence.

2013 Professor Klaus Riedle-Foundation annual prize and scholarship
Professor Riedle Scholarship aimed to enhance knowledge exchange between Friedrich-Alexander-University Erlangen-Nürnberg and Moscow Power Engeneering Institute, and allowed me to perform a 6-months academic stay in Erlangen (Germany).

PUBLICATIONS

2025 A. Guseva, L. Petitdemange and C. Pinçon.
Magnetic field morphologies in convective zones influenced by a turbulent surface layer
Accepted in Astronomy & Astrophysics.
`https://doi.org/10.48550/arXiv.2505.06618`

2025 A. Guseva, L. Petitdemange and S. M. Tobias.
Run-away transition to turbulent strong-field dynamo
Journal of Geophysical Research: Planets, 130, e2024JE008496.
`https://arxiv.org/abs/2405.10981`

2024 **A. Guseva.**
Data-driven scale identification in oscillatory dynamos
Monthly Notices of the Royal Astronomical Society, vol. 528, no. 2 (2024).
`https://doi.org/10.1093/mnras/stae079`

C. Pinçon, L. Petitdemange, R. Raynaud, L. J. Garcia, **A. Guseva**, M. Rieutord, and E. Alecian.
Coriolis darkening in late-type stars. II. Effect of self-sustained magnetic fields in stratified convective envelopes
Astronomy and Astrophysics-A&A, 685, A129 (2024)
`https://doi.org/10.1051/0004-6361/202349051`

A. Guseva, B. Snow, and Z. Wang.
Data-driven modelling of coherent structures in mixing layers
Proceedings of the NFFDy Summer Programme on 'Data in Fluids' (2024).
`https://doi.org/10.17863/CAM.107271`

2023 **A. Guseva** and S. M. Tobias.
Transition to chaos and modal structure of magnetized Taylor–Couette flow
Philosophical Transactions of the Royal Society A, 381 (2023).
`https://doi.org/10.1098/rsta.2022.0120`

2022 **A. Guseva** and J. Jiménez.
Linear instability and resonance effects in large-scale opposition flow control
Journal of Fluid Mechanics, 935, A35 (2022).
`https://doi.org/10.1017/jfm.2022.34`

2020 J. I. Ibrahim, **A. Guseva**, and R. Garcia-Mayoral.
Selective opposition-like control of large-scale structures in wall-bounded turbulence
Journal of Physics: Conference Series. Vol. 1522. No. 1. (2020)
`https://doi.org/10.1088/1742-6596/1522/1/012015`

F. Nauman and **A. Guseva**.
Energy transfers in magnetohydrodynamic shear turbulence
Journal of Physics: Conference Series. Vol. 1522. No. 1. (2020)
http://doi.org/10.1088/1742-6596/1522/1/012005

2018 G. Mamatsashvili, F. Stefani, **A. Guseva**, M. Avila
Nonlinear evolution of helical magnetorotational instability in a magnetized Taylor-Couette flow
New Journal of Physics 20, 013012 (2018)
https://doi.org/10.1088/1367-2630/aa9d65

2017 **A. Guseva**, A.P. Willis, R. Hollerbach, M. Avila
Dynamo action in a quasi-Keplerian Taylor-Couette flow
Physical Review Letters, 119, 164501
https://doi.org/10.1103/PhysRevLett.119.164501

A. Guseva, A.P. Willis, R. Hollerbach, M. Avila
Transport properties of the azimuthal magnetorotational instability
The Astrophysical Journal, 849:92 (2017)
https://doi.org/10.3847/1538-4357/aa917d

A. Guseva, A.P. Willis, R. Hollerbach, M. Avila
Azimuthal magnetorotational instability at low and high magnetic Prandtl numbers
Magnetohydrodynamics, 53, 1:25-34 (2017).
https://arxiv.org/abs/1611.07296

2016 M. Gellert, G. Rüdiger, M. Schultz, **A. Guseva**, R. Hollerbach
Nonaxisymmetric MHD instabilities of Chandrasekhar states in Taylor-Couette geometry
Astrophysical Journal, 823, 99:1-9 (2016).
https://doi.org/10.3847/0004-637X/823/2/99

2015 **A. Guseva**, A.P. Willis, R. Hollerbach, M. Avila
Transition to magnetorotational turbulence in Taylor-Couette flow with imposed azimuthal magnetic field
New Journal of Physics, 17, 093018:1-14 (2015).
https://doi.org/10.1088/1367-2630/17/9/093018

A. Kharicha, I. Teplyakov, Yu. Ivochkin, M. Wu, A. Ludwig, **A. Guseva**
Experimental and numerical analysis of free surface deformation in an electrically driven flow
Experimental Thermal and Fluid Science, 62, 192-201 (2015).
http://www.sciencedirect.com/science/article/pii/S0894177714002933

Y. Ivochkin, I. Teplyakov, **A. Guseva**, D. Vinogradov
Influence of the swirled electrovortex flow on the melting of eutectic alloy In-Ga-Sn
Magnetohydrodynamics, 51, 2:337-344 (2015).
http://mhd.sal.lv/contents/2015/2/MG.51.2.18.R.html

Teaching experience

2022-ongoing Magnetohydrodynamic instabilities and dynamo action, the Paris Observatory
A series of lectures and small research projects developed and delivered to master students in astrophysics as a part of the Gas Dynamics course

2023 Numerical Analysis course at the School of Mathematics, U. Leeds.
Weekly workshops for undegraduate students

2014-2015 Numerical methods for fluid mechanics, U. Erlangen-Nuremberg
Preparing new course structure and materials; giving seminars for graduate students in Mechanical, Chemical and Computational Engineering.

Supervision of students

2024-ongoing Elsa Louaas
Master-level research project "Modelling of convective-radiative interfaces using transpiring boundary condtions" at LERMA, the Paris Observatory

2023-ongoing Virgin Durepaire
PhD project "Magnetic instabilities in radiative stellar interiors"
at LERMA, the Paris Observatory
co-supervision with L. Petitdemange and K. Belkacem

2023 Joseph Hall
Undergraduate project "DMD for identification of topological waves in plasmas", in collaboration between U. Leeds and Brown University

2019-2020 Joseph Ibrahim
Expert supervision of the project "Selective opposition-like control of large-scale structures in wall-bounded turbulence", in collaboration between Polytechnic University of Madrid and University of Cambridge (PhD with Dr. R. Garcia-Mayoral)

2014-2015 Mohammed Ali Safari Shalmani
Master-level project "Parameter bounds of magnetorotational instability",
at University of Erlangen-Nuremberg

Selected talks and presentations

01/2025 Invited talk
Magnetic field dynamics in low mass stars
Severo Ochoa Colloquium, Institute of Astrophysics of Andalusia,(IAA-CSIC) Granada, Spain

12/2024 Invited talk
Magnetic field dynamics in low mass stars
Seminars of the Institut d'Astrophysique Spatiale (IAS), Paris, France

09/2024 Invited talk
Large scales in turbulent shear flows
EEBE Seminars on Computational Mechanics, Barcelona, Spain

04/2024 Invited talk
Data-driven approach to interaction between magnetic fields and rotating convection
FAST-LISN Seminar of mechanics, Paris, France

09/2023 A. Guseva, Ludovic Petitdemange, S. Tobias
Weak and strong dynamos: a data-driven analysis
Geophysical & Astrophysical Fluid Dynamics: Experiments and Models Nice, France

07/2023 A. Guseva, S. Tobias
Data-driven analysis of magnetorotational turbulence
National Astronomy Meeting, Cardiff, UK

11/2022 Invited talk
A data-driven approach to nonlinear dynamos
Seminars of the Institute of Space Sciences, Barcelona, Spain

10/2022 A. Guseva, S. Tobias
Data-driven reduced-order modelling of dynamo waves
Programme "Frontiers in dynamo theory: from the Earth to the stars", Isaac Newtown Insititute, Cambridge, UK

03/2022 Invited talk
Large-scale opposition flow control
Non-linear Physics Seminars, École normale supérieure, Paris, France

05/2021 A. Guseva, S. Tobias
Nonlinear dynamos: a data-driven approach
UKMHD 2021 conference (online)

09/2019 A. Guseva, M.P. Encinar, J. Jiménez
Active flow control of the logarithmic layer
17th European Turbulence Conference, Turin, Italy

09/2016 A. Guseva, A.P. Willis, R. Hollerbach, M. Avila
Angular momentum transport in quasi-Keplerian flows with imposed azimuthal magnetic field
11th European Fluid Mechanics Conference, Sevilla, Spain

06/2016 A. Guseva, A.P. Willis, R. Hollerbach, M. Avila
Transport properties of the azimuthal magnetorotational instability
10th PAMIR International Conference on Fundamental and Applied MHD, Cagliari, Italy

Contributions to research community

I served as a reviewer for the German Research Foundation (DFG), Dutch Research Council (NWO) and for several high-quality peer-reviewed journals:
- Monthly Notices of the Royal Astronomical Society
- Journal of Plasma Physics
- Journal of Fluid Mechanics
- Physical Review E
- Physical Review Fluids
- European Journal of Fluid Mechanics
- International Journal of Heat and Fluid Flow

Conference and seminar organization:
- Member of the scientific committee of Spanish Fluid Mechanics Conference 2025 (SFMC25)
- Interdisciplinary session "Magnetised stars and planets: combining theory and observations", National Astronomy Meeting, Cardiff, UK (2023)
- Seminars of Astrophysical and Geophysical Fluid Dynamics group, School of Mathematics, University of Leeds (2021-2023)
- The 4th Summer School on Turbulence, Madrid, Spain (2019)