

Simon Candelaresi

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Employment

2024 – today	Postdoctoral Researcher (SNUBIC project), University of Augsburg
2022 – 2024	Postdoctoral Researcher (SNUBIC project) at the High-Performance Computing Center, University of Stuttgart
2019 – 2022	Rankin-Sneddon Research Fellow at the University of Glasgow
2013 – 2019	Postdoctoral Research Fellow at the University of Dundee
2012-12-13	Degree of Doctor of Philosophy, subject: Astronomy title: “Magnetic helicity in astrophysical dynamos” awarded by Stockholm University
2011-02-11	Licentiate degree, subject: Astronomy, Stockholm University
2009-03 – 2012-12	PhD student at NORDITA and Stockholm University in Solar Physics
2008-05 – 2009-02	Research Assistant at the Institute for Computational Physics, Stuttgart
2006-02 – 2008-05	Developer for Embedded Linux at the Institute for Energy Transport and High Voltage, Stuttgart
2003-03 – 2004-07	Operator at the Dynamitron at the Institute for Radiational Physics, Stuttgart

Education

2005-08 – 2008-05	Final studies in Physics at the University of Stuttgart with concluding diploma thesis on “Fractional Approaches in Dielectric Broadband Spectroscopy”
2004-08 – 2005-07	ERASMUS exchange year at the University of Oslo
2001-10 – 2004-07	Diploma Student of Physics at the University of Stuttgart

Skills

Python, Julia, MPI, C/C++, CUDA, Fortran, \LaTeX , Trixi.jl, PENCIL CODE, Linux, Paraview, Blender, Html, Matlab, Django, Unity

Fields of Interest

Coupled Multiphysics Simulations
Topological Properties of Magnetic Flux Tubes
Magnetohydrodynamics
Solar Dynamos
GPGPU programming

Differential Geometry
Fractional Calculus

Research Schools Attended

1. School on Data Assimilation, Stockholm, 2011
2. Nordita Winter School 2010 on Dynamos: Above, Below, and In the Laboratory, Stockholm, 2010
3. XXI Canary Islands Winter School of Astrophysics, Puerto de la Cruz, 2009
4. CompSchool 2009: NBIA Summer School on Stellar Collapse, Compact Objects, Supernovae, and Gamma-Ray Bursts, Copenhagen, 2009

Professional Memberships

- Affiliate Member @ The Institute of Mathematics and its Applications (IMA)

Public Outreach

1. Maths Week Scotland, Dundee 2017
2. Nature's Equations – D'Arcy Thompson and the Beauty of Mathematics, Dundee 2015
3. Dundee Women in Science Festival, Dundee, 2015
4. Dundee Science Festival, Dundee, 2014
5. Dundee Science Festival, Dundee, 2013
6. GalileoMobile 2012
7. Fysik i Kungsträdgården, Stockholm, 2011

Teaching

1. Supervision of two Simulerte Welten Students, University of Stuttgart 2024
2. Tutorials on Dynamical Systems, University of Glasgow, 2022
3. Supervision of three level 4 Mathematics Students, 2021
4. Lecture on Numerical Methods, University of Glasgow, 2021
5. Supervision of two Mathematics Summer Project Students, 2021
6. Tutorials on Dynamical Systems, University of Glasgow, 2021
7. Supervision of one MSci Mathematics Student, 2020
8. Supervision of two level 4 Mathematics Students, 2020
9. Lecture on Numerical Methods, University of Glasgow, 2020
10. Supervision of one Mathematics Summer Project Student, 2020
11. Tutorials on Metric Spaces and Basic Topology, University of Glasgow, 2020
12. Lecture on Numerical Methods, University of Glasgow, 2019
13. Supervision of two Mathematics Summer Project Students, 2019
14. Supervision of one Mathematics Summer Project Student, 2018
15. Supervision of one MSc Mathematics Student, 2018
16. Supervision of three Mathematics Summer Project Students, 2017
17. Lecture on Differential Geometry, University of Dundee, 2017
18. Introduction to Scientific Python, University of Dundee, 2016
19. Supervision of one Mathematics Summer Project Student, 2016
20. Lecture on Differential Geometry, University of Dundee, 2016
21. Supervision of two Nuffield Research Students, 2015
22. Lecture on Discrete Mathematics, University of Dundee, 2014

Group and Science Support

1. Guest Editor for the journal on “Geophysical & Astrophysical Fluid Dynamics”, special issue: “Recent Developments in Magnetohydrodynamics and Dynamo Theory” (2021)
2. Organization of the 16th Pencil Code User Meeting (2020)
3. Organization of the Webinar on Magnetic Topology (2020)
4. Organization of the BAMC mini-symposium on “Recent Developments in Magnetohydrodynamics and Dynamo Theory” in Glasgow (2020, postponed to 2021)
5. Guest Editor for the journal on “Geophysical & Astrophysical Fluid Dynamics”, special issue: “Physics and Algorithms of the Pencil Code” (2017, 2018, 2019)
6. Organization of the workshop “Dundee Numerical Methods in MHD” (2018)
7. Setup and maintenance as administrator of a simulation cluster with 10 nodes and 320 cores
8. Student Recruitment at the University of Dundee (2013 – 2019)

Publications in Refereed Journals

1. **Candelaresi S.**, Beck C.
Twisted magnetic knots and links.
Phys. Plasmas, 30:082102, 2023.
2. **Candelaresi S.**, Hornig G., MacTaggart D., Simitov R. D.
On self and mutual winding helicity
Commun. Nonlinear. Sci. 103:106015, 2021
3. **Candelaresi S.**, Hornig G., Podger B., Pontin D. I.
Topological constraints in the reconnection of vortex braids.
Phys. Fluids, 33:056101, 2021.
4. The Pencil Code Collaboration
Journal of Open Source Software, 6:2807, 2021.
5. **Candelaresi S.**, Smiet C. B.
BlenDaViz, scientific visualization library for Blender.
submitted to Information Visualization, 2020
6. **Candelaresi S.**, Del Sordo F.
Stabilizing Effect of Magnetic Helicity on Magnetic Cavities in the Intergalactic Medium.
ApJ, 896:86, 2020.
7. Russell A. J. B., Demoulin P., Hornig G., Pontin D. I., **Candelaresi S.**
Do Current and Magnetic Helicities Have the Same Sign?
ApJ, 884:55, 2019.
8. Bracco A., **Candelaresi S.**, Del Sordo F. and Brandenburg A.
Is there a left-handed magnetic field in the solar neighborhood? Exploring helical magnetic fields in the interstellar medium through dust polarization power spectra.
A&A, 621:A97, 2019.
9. Akhmet'ev P. M., **Candelaresi S.** and Smirnov A. Y.
Minimum Quadratic Helicity States.
J. Plasma Phys., 84:6, 2018.
10. **Candelaresi S.**, Yeates A. R., Pontin D. I., Bushby P. J. and Hornig G.
Estimating the rate of field line braiding in the solar corona by photospheric flows.
ApJ, 864:157, 2018.
11. Akhmet'ev P. M., **Candelaresi S.** and Smirnov A. Y.
Calculations for the practical applications of quadratic helicity in MHD.
Phys. Plasmas, 24:102128, 2017.

12. **Candelaresi S.**, Pontin D. I. and Hornig G.
Quantifying the Tangling of Trajectories Using the Topological Entropy.
Chaos, 27:9, 2017.
13. Smiet C. B., **Candelaresi S.** and Bouwmeester D.
Ideal Relaxation of the Hopf Fibration.
Phys. Plasmas, 24:072110, 2017.
14. **Candelaresi S.**, Pontin D. and Hornig G.
Effects of Field-line Topology on Energy Propagation in the Corona.
ApJ, 832:150, 2016.
15. Pontin D. I., **Candelaresi S.**, Russell A. J. B. and Hornig G.
Braided magnetic fields: equilibria, relaxation and heating.
Plasma Phys. Contr. F., 58:5, 2016.
16. Smiet C. B., **Candelaresi S.**, Thompson A., Swearngin J., Dalhuisen J. W. and Bouwmeester D.
Self-organizing knotted magnetic structures in plasma.
Phys. Rev. Lett., 115:095001, 2015.
17. **Candelaresi S.**, Pontin D. and Hornig G.
Magnetic field relaxation and current sheets in an ideal plasma.
ApJ, 808:134, 2015.
18. **Candelaresi S.**, Pontin D. and Hornig G.
Mimetic methods for Lagrangian relaxation of magnetic fields.
SIAM J. Sci. Comput., 36:952, 2014.
19. **Candelaresi S.**, Hillier A., Maehara H., Brandenburg A. and Shibata K.
Superflare occurrence and energies on G-, K- and M-type dwarf.
ApJ, 792:67, 2014.
20. **Candelaresi S.** and Brandenburg A.
Kinetic helicity needed to drive large-scale dynamos.
Phys. Rev. E, 87:043104, 2013.
21. **Candelaresi S.** and Brandenburg A.
Decay of helical and non-helical magnetic knots.
Phys. Rev. E, 84:016406, 2011.
22. **Candelaresi S.**, Hubbard A., Brandenburg A. and Mitra D.
Magnetic helicity transport in the advective gauge family.
Phys. Plasmas, 18:012903, 2011.
23. Del Sordo F., **Candelaresi S.** and Brandenburg A.
Magnetic-field decay of three interlocked flux rings with zero linking number.
Phys. Rev. E, 81:036401, 2010.
24. Mitra D., **Candelaresi S.**, Chatterjee P., Tavakol R. and Brandenburg A.
Equatorial magnetic helicity flux in simulations with different gauges.
Astron. Nachr., 331:130-135, 2010.
25. Brandenburg A., **Candelaresi S.** and Chatterjee P.
Small-scale magnetic helicity losses from a mean-field dynamo.
Mon. Not. R. Astron. Soc., 398:1414-1422, 2009.

Book Chapters

1. **Candelaresi S.**, Del Sordo, F.
Stability of plasmas through magnetic helicity.
Helicities in Geophysics, Astrophysics, and Beyond, 2023

Conference Proceedings

1. **Candelaresi S.**, Pontin D. I. and Hornig G.
Magnetic field line braiding in the solar atmosphere.
In *Fine Structure and Dynamics of the Solar Atmosphere*, 327:77-81, 2017.
2. **Candelaresi S.** and Hilfer R.
Excess wings in broadband dielectric spectroscopy.
In *AIP Conference Proceedings*, 1637:1283-1290, 2014.
3. **Candelaresi S.**
Topological constraints in magnetic field relaxation.
In *Journal of Physics: Conference Series*, 544:12006, 2014.
4. **Candelaresi S.** and Brandenburg A.
Topological constraints on magnetic field relaxation.
In *Solar and Astrophysical Dynamos and Magnetic Activity of IAU Symposium*, 294:353-357, 2012.
5. **Candelaresi S.** and Brandenburg A.
Magnetic helicity fluxes and their effect on stellar dynamos.
In *Comparative Magnetic Minima: characterizing Quiet Times in the Sun and Stars of IAU Symposium*, 286:49-53, 2012.
6. **Candelaresi S.** and Brandenburg A.
Magnetic helicity fluxes in alpha omega dynamos.
In *Advances in Plasma Astrophysics of IAU Symposium*, 274:464-466, 2011.
7. **Candelaresi S.**, Del Sordo F. and Brandenburg A.
Decay of trefoil and other magnetic knots.
In *Advances in Plasma Astrophysics of IAU Symposium*, 274:461-463, 2011.
8. **Candelaresi S.**, Del Sordo F. and Brandenburg A.
Influence of magnetic helicity in MHD.
In *Astrophysical Dynamics – from Stars to Galaxies of IAU Symposium*, 271:369-370, 2011.

Conferences

1. PASC24, Zurich (2024)
Talk: “Adaptively coupled multiphysics simulations with Trixi.jl”
2. BAMC 2024, Newcastle (2024)
Talk: “Twisted magnetic knots and links and their current alignment”
3. National Astronomy Meeting, Warwick (2022)
Talk: “Polynomial knot invariants in the dynamics of braided magnetic fields”
4. UKMHD 2022, Sheffield (2022)
Talk: “The role of magnetic helicity in stabilising magnetic cavities in the intergalactic medium”
5. 15th Pencil Code User Meeting, virtual (2022)
Talk: “Numerical wave damping in the Pencil Code”
6. National Astronomy Meeting, virtual (2021)
Poster: “Stabilizing effect of magnetic helicity on magnetic cavities in the intergalactic medium.”
7. UKMHD, virtual (2021)
Talk: “Vortex Reconnection and the Role of Topology”
8. 14th Pencil Code User Meeting, virtual (2021)
Talk: “Numerical Viscosity and Diffusion in Finite Difference Eulerian Codes”
9. BMC-BAMC meeting, virtual (2021)
Organizer

10. Helicity 2020, virtual (2020)
Talk: “Magnetic helicity in periodic domains.”
11. 16th Pencil Code User Meeting, virtual (2020)
Organizer
12. Magnetic Fields in the Universe 7, Quy Nhon (2020)
Talk: “Stabilizing Effect of Magnetic Helicity on Magnetic Cavities in the Intergalactic Medium”
13. 15th Pencil Code User Meeting, Espoo (2019)
Talks: “BlendaViz”
“Quo vadis pencilnew?”
14. ISSI meeting, Magnetic Helicity in Astrophysical Plasmas, Bern (2019)
Talk: “Helicity Fluxes in Dependence of the Gauge”
15. 9th Coronal Loops Workshop, St Andrews (2019)
Talk: “Field line winding and tangling in the solar corona”
16. 32nd Scottish Fluid Mechanics Meeting, Dundee (2019)
Talk: “Relaxation of Vortex Braids”
17. ISSI meeting, Magnetic Helicity in Astrophysical Plasmas, Bern (2018)
Talk: “Topology conserving magnetic field relaxation”
18. Hinode 12, The many Suns, Granada (2018)
Talk: “Field Line Braiding in the Solar Corona by Photospheric Flows”
19. Model coupling and data driven simulations of solar eruptions, Boulder (2018)
Talk: “Measuring Tangling in the Solar Photosphere”
20. UKMHD 2018, St Andrews (2018)
Talk: “Rate of Field line Braiding in the Solar Corona”
21. Topological Science Symposium 2017, Yokohama (2017)
Invited Talk: “Topology Conserving Magnetic Field Evolution”
22. Helicity Thinkshop 3, Tokyo (2017)
Talk: “Topology Conserving Magnetic Field Evolution”
23. 13th Pencil Code User Meeting, Newcastle (2017)
Talk: “PencilCode and Python”
24. 8th Coronal Loops Workshop, Palermo (2017)
Talk: “Measuring Magnetic Field Tangling Using the Topological Entropy”
25. Phase Transitions in Astrophysics, from ISM to Planets, Stockholm (2017)
Seminar: “Practical Python for Researchers”
26. UKMHD 2017, Durham (2017)
Talk: “Magnetic Field Line Tangling and Topological Entropy”
27. 327 IAU, Cartagena de Indias (2016)
Talk: “Magnetic Field Line Braiding in the Solar Atmosphere”
28. SPD2016, Boulder (2016)
Talk: “Magnetic Field Line Topology and Energy Propagation in the Corona”
29. IUTAM Symposium on Helicity, structures and singularity in fluid and plasma dynamics, Venice (2016)
Talk: “Topology Conserving Magnetic Field Relaxation in Plasma”
30. IPELS2015, Pitlochry (2015)
Talk: “Current Formation During Magnetic Field Relaxation”
31. Coronal Loop Workshop VII, Cambridge (2015)
Talk: “Current Sheet Formation During the Ideal Relaxation of Magnetic Fields”
32. National Astronomy Meeting, Llandudno (2015)
Talk: “Magnetic field relaxation and current concentrations in plasma”
Poster: “Flare survey for G, K and M type stars”

33. Mysteries of the Sun's magnetic field III: Understanding stellar activity, Warwick (2015)
Invited talk: "Superflares in G, K and M Type Dwarfs from Kepler Observations"
34. UKMHD, Newcastle (2015)
Talk: "Current Formation During Magnetic Field Relaxation"
35. 11th Pencil Code User Meeting, Trondheim (2015)
Talk: "Magnetic Vector Potentials and Helicity in Periodic Domains"
36. Magnetic Reconnection: Where Now and Where Next?, London (2014)
37. 14th European Solar Physics Meeting, Dublin (2014)
Poster: "Force-Free Relaxation of Braided Coronal Magnetic Fields"
38. 10th Pencil Code User Meeting, Göttingen (2014)
Talk: "Lagrangian Relaxation of Magnetic Fields"
39. Solar and Stellar Flares, Prague (2014)
Poster: "Superflares in G, K and M Type Dwarfs "
40. ESF Exploratory Workshop, Glasgow (2014)
Talk: "Lagrangian Relaxation of Magnetic Fields"
41. National Astronomy Meeting, St Andrews (2013)
42. Magnetic Fields in the Universe IV, Playa del Carmen (2013)
Poster: "The Kinetic Helicity Needed to Drive Large-Scale Dynamoes"
43. Dynamo Workshop, Kyoto (2012)
Talk: "Magnetic helicity conservation and fluxes in astrophysical dynamoes"
44. Tangled Magnetic Fields in Astro- and Plasma Physics, Edinburgh (2012)
Talk: "Topological restrictions in magnetic field dynamics and reconnection"
45. 294 IAU: Solar and astrophysical dynamoes and magnetic activity, Beijing (2012)
Talk: "Topological restrictions in magnetic field dynamics and reconnection"
46. 8th Pencil Code User Meeting, Helsinki (2012)
47. 286 IAU: Comparative Magnetic Minima, Mendoza (2011)
Talk: "Magnetic Helicity Fluxes and their Effect on the Solar Dynamo"
48. Dynamo, Dynamical Systems and Topology, Stockholm (2011)
Talk: "Magnetic helicity: topological interpretation, relaxation and transport"
49. Knots and Links: From Form to Function, Pisa (2011)
Talk: "Decay of helical and non-helical magnetic links and knots"
50. Topology in Fluid Flow Visualization, Pisa (2011)
Invited talk: "Decay of helical and non-helical magnetic links and knots"
51. RädlerFest: Alpha Effect and Beyond, Stockholm (2011)
Talk: "Magnetic helicity transport in the advective gauge family"
52. 274 IAU Symposium, Advances in Plasma Astrophysics, Giardini-Naxos (2010)
Posters: "Magnetic Helicity and its Topological Interpretation"
"Helicity Fluxes and Gauge Issues in Turbulent Dynamoes"
53. 6th Pencil Code User Meeting, New York (2010)
54. 271 IAU Symposium, Astrophysical Dynamics: From Stars to Galaxies, Nice (2010)
Posters: "Magnetic Helicity and its Topological Interpretation"
"Helicity Fluxes and Gauge Issues in Turbulent Dynamoes"
55. Magnetic fields on scales from kilometres to kiloparsecs: properties and origin, Krakow (2010)
Posters: "Magnetic Helicity and its Topological Interpretation"
"Helicity Fluxes and Gauge Issues in Turbulent Dynamoes"
56. Nordita Winter School on Dynamoes, Stockholm (2010)
Talk: "Magnetic Helicity and its Topological Interpretation"
57. 5th Pencil Code User Meeting, Heidelberg (2009)

58. Astrophysical Magnetohydrodynamics, Kiljavanranta (2009)
Talk: “Magnetic helicity fluxes in an α^2 dynamo”
59. 72nd Annual Meeting of the DPG, Berlin (2008)
Talk: “Fractional approaches in dielectric broadband spectroscopy”

Working Visits

1. “Hopf kinks in the galactic magnetic fields”
with Daniel Weil at the The Hebrew University of Jerusalem, Israel, for 1 week during August 2023
2. “Hopf kinks in the galactic magnetic fields”
with Daniel Weil at the The Hebrew University of Jerusalem, Israel, for 1 week during July 2022
3. “Stabilizing effect of magnetic helicity on magnetic cavities in the intergalactic medium”
with Fabio Del Sordo at the University of Crete, Greece, for 3 weeks during July 2018
4. “Plasma self-confinement in knots”
with Dirk Bouwmeester and Chris Smiet at the University of Leiden, Netherlands, for 1 week during March 2015
5. “Observational signatures of magnetic helicity in the local dynamo”
with Kazunari Shibata at Kwasan Observatory Kyoto University, Japan, for 5 weeks during October and November 2012
6. “Turbulent cross helicity in astrophysical dynamos”
with Nobumitsu Yokoi at Tokyo University, Japan, for 4.5 weeks during June and July 2012
7. “Magnetic reconnection and field line topology in magnetic relaxation”
with Anthony Yeates at the University of Durham, UK, for 6 weeks during February and March 2012

Honors and Grants

1. QJMAM Fund for Applied Mathematics from IMA 2020, 800 GBP
2. QJMAM Fund for Applied Mathematics from IMA 2018, 260 GBP
3. Royal Astronomical Society 2018, 500 GBP
4. HPC-Europa3 Transnational Access programme: collaborative research visits using High Performance Computing, collaboration with Fabio Del Sordo, 2018
5. Travel grant, IAU Symposium No. 327: Fine Structure and Dynamics of the Solar Atmosphere, Cartagena de Indias, Colombia, October 2016, 740 EUR
6. Edinburgh Mathematical Society Research Support Fund 2015, 700 GBP
7. Winton Capital Postdoctoral Poster Prize 2015, 350 GBP
8. GCOE Bilateral International Exchange Program for Visiting Students, collaboration with Kazunari Shibata at Kwasan Observatory, Kyoto University, November 2012
9. Travel grant, IAU Symposium No. 294: Solar and astrophysical dynamos and magnetic activity, Beijing, August 2012, 540 EUR
10. JSPS Grants-in-Aid for Scientific Research: No. 24540228 provided by Nobumitsu Yokoi in connection with our collaboration, July 2012, 113000 JPY
11. Stiftelsen Hierta-Retzius stipendiefond: Turbulent cross helicity in astrophysical dynamos, collaboration with Nobumitsu Yokoi, Tokyo, 2012, 2500 SEK
12. Stiftelsen Th Nordströms testamentfond: Turbulent cross helicity in astrophysical dynamos, collaboration with Nobumitsu Yokoi, Tokyo, 2012, 17500 SEK
13. HPC-Europa2 Transnational Access programme: collaborative research visits using High Performance Computing, collaboration with Anthony Yeates, 2012

14. Travel grant, IAU Symposium No. 286: Comparative magnetic minima: characterizing quiet times in the Sun and stars, Mendoza, October 2011, 1030 EUR
15. Travel grant, European Science Foundation, Knots and Links: From Form to Function, Pisa, Italy, July 2011, 200 EUR
16. Travel grant, IAU Symposium No. 271: Astrophysical Dynamics : From Stars to Galaxies, Nice, France, June 2010, 500 EUR