

CV - Tom Elsdén

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Employment & Education

- *Sep 2022 - Present*: Lecturer in Mathematics and Statistics, University of St Andrews.
 - *Oct 2021 - Aug 2022*: Leverhulme Early Career Research Fellow and Rankin-Sneddon Fellow, University of Glasgow.
 - *Oct 2019 - Sep 2021*: Leverhulme Early Career Research Fellow, University of Leicester.
 - *June 2016 - Sep 2019*: Post Doctoral Research Assistant on a Leverhulme Research Project Grant, University of St Andrews.
 - *Sep 2012 - June 2016*: PhD in Applied Mathematics, University of St Andrews.
 - *June 2011 - Aug 2011*: Research Experience for Undergraduates (REU) Programme, Harvard Smithsonian Centre for Astrophysics.
 - *Sep 2008 - June 2012*: MMath (Hons) Mathematics - First Class, University of St Andrews.
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Research Area and Activity

My research focusses on large scale plasma waves, known as ultra-low frequency (ULF) waves, in Earth's magnetosphere - the space around the Earth dominated by the Earth's magnetic field. These waves are an important aspect of space weather, driving aurora and radiation in near-Earth space. I use computational magnetohydrodynamic (MHD) modelling to understand and predict the role of ULF waves in Earth's magnetospheric system.

I have written 30 research papers (27 published, 1 accepted, 2 in review), with 12 as first author and 8 as second author, in leading journals for my field such as:

- Journal of Geophysical Research (JGR): Space Physics (18),
- Geophysical Research Letters (GRL) (3),
- Frontiers in Astronomy and Space Science (4),
- Invited single author review to appear in Oxford Research Encyclopedia of Planetary Science,
- Invited book chapter in AGU Geophysical Monograph Series.

I have delivered over 40 external research talks, over 20 of which have been invited talks, including at the American Geophysical Union annual meetings, the largest conference for my discipline. I have regularly organised sessions at national and international conferences, as well as co-organising the largest UK PhD oriented summer school in my field, the STFC Introductory Course in Solar and Solar-Terrestrial Physics, in 2023: [link](#). I have 281 citations and an h-index of 10 (Google scholar).

Grants, Appointments and Memberships

- 2019 - 2022, Leverhulme Early Career Fellowship entitled *Resonating Magnetic Field Lines: A Process for Energy Transfer at Earth/Mercury*, University of Leicester, £93000.
- Co-I on STFC Knowledge Exchange Institutional Award, 2023, entitled *Sharing the History and Science of Total Solar Eclipses*, £16000.
- UK liaison to the US Geophysical Environment Modelling (GEM) community.
- Core member of 2 International Space Science Institute (ISSI) teams from 2019-2024.
- Lead of public outreach activities in mathematics and statistics, University of St Andrews.
- Fellow of the Royal Astronomical Society.

- Member of the American Geophysical Union (AGU).
- Regular reviewer (2-3 per year) for journals JGR Space Physics, GRL and Frontiers in Astronomy and Space Science and grant applications for STFC.

Teaching and Supervision

I have lectured several courses while at St Andrews. Below I list these modules, where * means that I was the module coordinator, together with an average feedback score from student questionnaires on a 1 (good) to 5 (bad) scale. Students are asked questions about the lecturer specifically as to whether lectures were well organised, well explained, well presented and could they contact me if needed.

Year	Semester	Module	Class Size	Average Score (1 to 5)
2022/2023	2	MT4507 Classical Mechanics*	26	1.13
2023/2024	1	MT2503 Multivariate Calculus*	238	1.29
2023/2024	2	MT4510 Solar Theory*	29	1.07
2024/2025	1	MT1002 Mathematics	264	1.21

As a post doctoral researcher at the University of Glasgow, I lectured on the modules Mathematics 1C and Mechanics 2E in the 2021/2022 academic year.

- I am currently the primary supervisor for one PhD student, James Brooks, who started in September 2024, funded by an STFC Doctoral Training Partnership (DTP) grant, ST/Y509577/1, to the solar and magnetospheric research group at St Andrews.
- I am second supervisor (10%) to one further PhD student, Rachel Davies, due to finish this year.
- In summer 2023 I supervised 6 undergraduate summer students, on a STFC funded knowledge exchange project to create a website sharing the history and science of total solar eclipses ([link](#)).
- I have supervised a further summer student and 5 undergraduate final year projects (2 Masters, 3 BSc) at St Andrews.
- Internal viva examiner for the PhD thesis of Kate Mowbray on 15/01/2025.

Publications

30. Adnane Osmane, Jasmine Sandhu, **Tom Elsdén**, Oliver Allanson, Lucile Turc, Radial Diffusion Driven by Spatially Localized ULF Waves in the Earth's Magnetosphere, *submitted* to GRL.
29. Wright, A. N., **Elsden, T.**, Degeling, A., Mann, I. R., Ozeke, L., Yeoman, T., Sandhu, J., Takahashi, T., Poloidal Field Line Resonances Driven by a Fast Wave, *submitted* to GRL.
28. **Elsden, T.**, Ultra Low Frequency Waves of Earth's Magnetosphere – Review Article, (*accepted* by Oxford Research Encyclopedia of Planetary Science).
27. Archer MO, Pilipenko VA, Li B, Sorathia K, Nakariakov VM, **Elsden T** and Nykyri K (2024) Magnetopause MHD surface wave theory: progress & challenges. *Front. Astron. Space Sci.* 11:1407172. doi: 10.3389/fspas.2024.1407172
26. Wright, A.N., Hartinger, M.D., Takahashi, K. and **Elsden, T.** (2024). Alfvén Waves in the Earth's Magnetosphere. In *Alfvén Waves Across Heliophysics*, A. Keiling (Ed.). doi:10.1002/9781394195985.ch10
25. Allanson O, Ma D, Osmane A, Albert JM, Bortnik J, Watt CEJ, Chapman SC, Spencer J, Ratliff DJ, Meredith NP, **Elsden T**, Neukirch T, Hartley DP, Black R, Watkins NW and Elvidge S (2024) The challenge to understand the zoo of particle transport regimes during resonant wave-particle interactions for given survey-mode wave spectra. *Front. Astron. Space Sci.* 11:1332931. doi:10.3389/fspas.2024.1332931
24. Sandhu, J. K., Degeling, A. W., **Elsden, T.**, Murphy, K. R., Rae, I. J., Wright, A. N., et al. (2023). Van Allen Probes observations of a three-dimensional field line resonance at a plasmaspheric plume. *GRL*, 50, doi:10.1029/2023GL106715
23. Hartinger, M. D., **Elsden, T.**, Archer, M. O., Takahashi, K., Wright, A. N., Artemyev, A., et al. (2023). Properties of Magnetohydrodynamic normal modes in the Earth's Magnetosphere. *JGR: Space Physics*, 128, doi:10.1029/2023JA031987

22. Takahashi, K., **Elsden, T.**, Wright, A. N., & Degeling, A. W. (2023). Polarization of magnetospheric ULF waves excited by an interplanetary shock on 27 February 2014. *JGR: Space Physics*, 128, doi:10.1029/2023JA031608
21. Wright, A., & **Elsden, T.** (2023). Resonant Fast-Alfvén Wave Coupling in a 3D Coronal Arcade. *Physics*, 5(1), 310-321. doi:10.3390/physics5010023
20. **Elsden, T.** & Southwood, D. J. (2023). Modeling features of field line resonance observable by a single spacecraft at Saturn. *JGR: Space Physics*, 128, doi:10.1029/2022JA031208
19. Fogg, A. R., Lester, M., Yeoman, T. K., Carter, J. A., Milan, S. E., Sangha, H. K., **Elsden, T.** et al. (2023). Multi-instrument observations of the effects of a solar wind pressure pulse on the high latitude ionosphere: A detailed case study of a geomagnetic sudden impulse. *JGR: Space Physics*, 128, doi:10.1029/2022JA031136
18. **Tom Elsden**, Matthew K James, Jasmine K Sandhu, Clare Watt, RAS Specialist Discussion Meeting Report, Astronomy & Geophysics, Volume 63, Issue 5, October 2022, Pages 5.26–5.30, doi.org/10.1093/astrogeo/atac066
17. **Elsden, T.**, Wright A and Degeling A (2022) A review of the theory of 3-D Alfvén (field line) resonances. *Front. Astron. Space Sci.* 9:917817. doi: 10.3389/fspas.2022.917817
16. Sakurai, T., Wright, A. N., Takahashi, K., **Elsden, T.**, Ebihara, Y., Sato, N., et al. (2022). Poleward moving auroral arcs and Pc5 oscillations. *JGR: Space Physics*, 127, doi:10.1029/2022JA030362
15. Wright, A. N., Degeling, A., **Elsden, T.** (2022). Resonance Maps for 3D Alfvén Waves in a Compressed Dipole Field, *JGR: Space Physics*, 127, 10.1029/2022JA030294.
14. **Elsden, T.**, Wright, A. N. (2022). Polarization Properties of 3-D Field Line Resonances, *JGR: Space Physics*, 127, doi:10.1029/2021JA030080.
13. **Elsden, T.**, Yeoman, T.K., Wharton, S. J., Rae, I. J., Sandhu, J. K., Walach, M.-T., James, M. K., Wright, D. M. (2022). Modeling the Varying Location of Field Line Resonances During Geomagnetic Storms, *JGR: Space Physics*, 127, doi:10.1029/2021JA029804.
12. Allanson, O., **Elsden T.**, Watt, C., Neukirch, T. (2022). Weak Turbulence and Quasilinear Diffusion for Relativistic Wave-Particle Interactions via a Markov Approach. *Frontiers in Astronomy and Space Sciences*, 14 January 2022. doi:10.3389/fspas.2021.805699.
11. Sandhu, J. K., Rae, I. J., Staples, F. A., Hartley, D. P., Walach, M.-T., **Elsden, T.**, Murphy, K. R. (2021). The roles of the magnetopause and plasmopause in storm-time ULF wave power enhancements. *JGR: Space Physics*, 126, doi:10.1029/2021JA029337
10. Southwood, D. J., Cao, H., Shebanits, O., **Elsden, T.**, Hunt, G., Dougherty, M. (2021), Discovery of Alfvén Waves Planetward of Saturn’s Rings, *JGR: Space Physics*, 125, doi:10.1029/2020JA028473.
9. **Elsden, T.**, A. N. Wright, (2020), Evolution of High-m Poloidal Alfvén Waves in a Dipole Magnetic Field, *JGR: Space Physics*, 125, doi:10.1029/2020JA028187.
8. Wright, A. N., **Elsden, T.** (2020), Simulations of MHD wave propagation and coupling in a 3-D magnetosphere, *JGR: Space Physics*, 125, doi:10.1029/2019JA027589.
7. **Elsden, T.**, A. N. Wright, (2019), The Effect of Fast Normal Mode Structure and Magnetopause Forcing on FLRs in a 3D Waveguide, *JGR Space Physics*, 124, doi:10.1029/2018JA026222.
6. Wright, A. N., **Elsden, T.**, K. Takahashi, (2018) Modeling the Dawn/Dusk Asymmetry of Field Line Resonances, *JGR Space Physics*, 123, doi:10.1029/2018JA025638.
5. **Elsden, T.**, A. N. Wright (2018), The Broadband Excitation of 3D Alfvén Resonances in a MHD Waveguide, *JGR Space Physics*, 123, doi:10.1002/2017JA025018.
4. **Elsden, T.**, A. N. Wright (2017), The Theoretical Foundation of 3D Alfvén Resonances: Time Dependent Solutions, *JGR Space Physics*, 122, doi:10.1002/2016JA023811.
3. Wright, A. N., **Elsden, T.** (2016), The Theoretical Foundation of 3D Alfvén Resonances: Normal Modes, *Astrophysical Journal*, 833, 230, doi:10.3847/1538-4357/833/2/230 .
2. **Elsden, T.**, A. N. Wright, M. D. Hartinger (2016), Deciphering satellite observations of compressional ULF waveguide modes, *JGR Space Physics*, 121, doi:10.1002/2016JA022351.
1. **Elsden, T.**, A. N. Wright (2015), The use of the Poynting vector in interpreting ULF waves in magnetospheric waveguides, *JGR Space Physics*, 120, doi:10.1002/2014JA020748.