Sarah Bentley

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Personal profile

I investigate how magnetospheric plasma waves drive Earth's radiation belts using data analysis, machine learning and analytical approaches. I also intend to address more general underlying difficulties in space physics data analysis, by applying statistical and machine learning techniques and by developing novel methods where appropriate.

Education and work

Northumbria University, Department of Mathematics, Physics and Electrical Engineering, 2020 – present
Vice-Chancellor's Fellow

University of Reading, Department of Meteorology, 2018 – 2020
Post-Doctoral Research Associate in Radiation Belt Physics: STFC-funded position to study the properties of electromagnetic waves throughout the inner magnetosphere, reporting to Clare Watt.

University of Reading, 2015 – 2018
PhD, "Predicting the effect of the solar wind on the waves that drive Earth's radiation belts"
Supervised by Clare Watt and Mathew Owens.

Siemens (Parasolid), 2014 – 2015
Software Engineer: I maintained and developed the geometry kernel underlying CAD systems. I was responsible for my own functional area and developed new algorithms to support it. These software and coding skills have been invaluable in research.

University of Durham, 2009 – 2013
MMath (Dunelm) Class I (Hons): A range of pure mathematical and theoretical physics modules plus a research project in my final year, "Black Hole Membrane Paradigm".

My research

I currently study the effect of ultra-low frequency (ULF) magnetospheric plasma waves on the Earth's radiation belts, creating empirical models to characterise these waves and investigating the theory determining their interaction with radiation belt electrons. My two long-term goals relate to our understanding of these waves and their effects, and also to developing mathematical techniques to address some of the data analysis difficulties specific to space physics (correlation, causality, observation sparsity). Together, these two goals represent some the current limits to space weather forecasting, and I have identified and begun tackling the steps to address each of them.

Research management and teaching

- **Research leadership:** includes running undergraduate research projects and developing a research plan to tackle the outstanding science questions outlined in the My Research section.

- **Managing long term projects**: During my PhD and as post-doctoral research associate I had to identify and carry out numerous smaller tasks necessary to achieve my final goal.
- **Planning scientifically significant research**: I am involved in planning a large NERC grant proposal worth ~£3m in total. My role as Co-Investigator will be to identify feasible ways of comparing different theoretical formalisms for the dynamics of electrons in a numerical model.
- **Supervising research students**: I co-supervised an undergraduate research project during my PhD (2018). Last summer (2019) I supervised another undergraduate research student, encouraging them to select a research question that also met their personal goals. Our paper has been submitted to *Earth and Space Sciences.*
- **Teaching and tutorials:** My teaching roles have been in maths, physics and programming modules and include marking, group and individual tutorials.

Publications, presentations and funding

- **Publications:** I have contributed to 14 papers, including 2 first author papers and another under review. (My ORCiD: 0000-0002-0095-1979)
- **Funding:** I have received funding for five travel bursaries (total ~£2550), for two undergraduate student summer projects (total ~£2520) and for other purposes such as support for the International School/Symposium for Space Simulations (ISSS-13, UCLA 2018) and the PROGRESS Space Weather Summer School (Mallorca, 2017)
- **International and national presentations:** I have presented my work over thirty times to national and international audiences, and have attended specialist workshops. Noted conference attendance include the American (2017) and European (2019) Geophysical Union Meetings and the Chapman Conference on Particle Dynamics in the Earth's Radiation Belts (2018).

Active in the space physics community

- **Meeting proposals:** I have co-organised discussion meetings and was lead proposer for a session in the National Astronomy Meeting, which will now be a merged session in the postponed conference next year.
- **Referee** for *Journal of Space Weather and Space Climate, Journal of Geophysical Research: Space Physics*
- **National collaborations:** I have contributed to meetings and publications of the RAD-SAT consortium, which aims to improve radiation belt forecasting abilities.
- **International collaborations:** I have worked with international colleagues on past publications and to determine the research proposed in our NERC large grant proposal.
- **Hosted** academic visits of Jasmine Sandhu (UCL, Jan 2020), Elizabeth Tindale (Warwick, March 2019)
- **Invited talks:** at University of Leicester (Jan 2020), Mullard Space Science Laboratory (May 2019) and Imperial College London (Feb 2019)

Awards and miscellaneous skills

- **2019 Ian James Prize,** Department of Meteorology thesis prize
- **2016 1st Research Poster Prize,** South East Physics Network GRADnet Summer School
- **Numerous computing tools:** I have used Python and MATLAB regularly and rely on collaborative tools such as Overleaf, Google Docs and GitHub to work effectively. I can use command line Linux/Unix.
- **Software development practices:** I utilise best practice in my coding, from version control with git to test suites. My recent model is being published in easily accessible form with full documentation.

References on request.