

Daniel R. Wilkins

Ph.D., M.Sci., M.A. (Cantab), FRAS

Research Interests

Mapping the extreme environments around black holes to understand how matter falling into black holes powers active galactic nuclei (AGN), X-ray emission and jets. Research includes development of general relativistic ray tracing simulations and new data analysis and statistical modelling techniques, general relativity, X-ray astronomy, high performance computing, algorithm development for X-ray detectors.

Education

Institute of Astronomy, University of Cambridge

2013 *Ph.D.* Astronomy (Supervised by Prof. Andrew C. Fabian)
Thesis title: Understanding X-ray Reflection as a Probe of Accreting Black Holes

Jesus College, University of Cambridge

2009 *M.Sci., M.A. (Cantab)* Natural Sciences – *First Class with Honours*
Specialised in Experimental and Theoretical Physics, completing a research project in astrophysics (computer simulations of radiative transfer during the formation of stars). Studied courses in Mathematics, Chemistry, Biology of Cells and Nuclear Power Engineering. Awarded a Foundation Scholarship from Jesus College from 2006 to 2010 and won the College prize in Physics in 2008 and 2009.

Career

2016- Stanford University (Kavli Institute for Particle Astrophysics & Cosmology), Stanford, CA
NASA Einstein Fellow (2016-19), Kavli Fellow (2019-20), Research Scientist (2019-23)

2013-16 Saint Mary's University, Halifax, NS, Canada
CITA National Fellow (2013-15) & Postdoctoral Research Fellow (2015-16)

2009-13 University of Cambridge (Institute of Astronomy), Cambridge, UK
Ph.D. Student

2004-8 STFC Rutherford Appleton Laboratory, Chilton, Didcot, UK
Vacation Research Student (2006, 07 and 08) and Nuffield Bursary Student (2004)

Professional Organisations

- Fellow, Royal Astronomical Society
- Full Member, American Astronomical Society

Awards

Research Fellowships

2021 *Ernest Rutherford Fellowship*, UK Research and Innovation, Science & Technology Facilities Council (offer declined)

2019-20 *Kavli Fellowship*, Stanford University

2016-19 *Einstein Fellowship*, National Aeronautics and Space Administration

2013-15 *National Fellowship*, Canadian Institute for Theoretical Astrophysics

2019-13 Ph.D. Studentship, United Kingdom Science & Technology Facilities Council

Research Funding

- \$1.02M award from the NASA *Astrophysics Research and Analysis (APRA)* Program as Science-PI (2021-2024)
- \$470,000 award from the NASA *Astrophysics Data Analysis Program (ADAP)* as Science-PI (2022-2025)
- \$101,000 previous plus \$191,000 pending awards through NASA *NuSTAR* and *XMM-Newton* guest observer programmes as PI

Telescope Observing Time

- 950ks observing time (3 programs) with *NuSTAR* and 130ks (1 program) with *XMM-Newton* as principal investigator
- 2.5Ms total observing time with *XMM-Newton* as co-investigator including large and very large programmes

Professional Service

- Member of the instrument consortium for the European Space Agency's *Athena Wide Field Imager* (NASA/US contribution), and of the *Athena* Community Science Working Group
- Member of the *Hitomi* Science Working Group and co-lead of PV phase observing proposal teams
- Member of the NASA *Lynx* science working groups for Extreme Physics and Black Hole Feedback
- Member of the *STROBE-X* probe-class mission study team
- Referee for the journals *Monthly Notices of the Royal Astronomical Society* (MNRAS), *The Astrophysical Journal* (ApJ), *Astronomy & Astrophysics* (A&A), *Proceedings of the Astronomical Society of Japan* (PASJ), *Journal of Cosmology and Astroparticle Physics* (JCAP) and the *Journal of Applied Statistics* (CJAS)
- Panellist for the *Chandra*, *NuSTAR*, and *XMM-Newton* time allocation committees and NASA *Astrophysics Data Analysis Program* funding panel. Reviewer for the *Canadian Time Allocation Committee*, NASA *NESSF Fellowship*, the Czech Science Foundation, the Netherlands Research Council *Veni Grant and Talent Scheme*, and the Israel Science Foundation
- Co-chair of the KIPAC postdoctoral fellowships committee at Stanford University, 2021
- Member of the graduate student admissions committee for astrophysics at Stanford University, 2018-21
- Member of a topical panel, advising the Canadian Space Agency on investment in high energy astrophysics (2015) and co-lead author of whitepapers for the 2020 *Decadal Survey in Astronomy and Astrophysics*
- *Chambliss Student Poster Award* judge, 223rd and 225th AAS Meetings, January 2014 and 2015
- Session chair at the 30th Texas Symposium (December 2019) and the 225th AAS Meeting (January 2015)
- Member of the scientific organising committee for the 2016 Lorentz Centre Workshop 'The X-ray Spectral Timing Revolution'
- Member of the organizing committee, hosting and selecting talks for KIPAC Tea meetings at Stanford University

Teaching

- Lecturer for undergraduate courses at Stanford University: Instructor of record for Physics 17, *Black Holes & Extreme Astrophysics* (Fall 2020). Guest lectures in Physics 12N, *Black Holes, Fact & Fancy* (non-science majors); Physics 100, *Introduction to Observational Astrophysics*; Physics 364, *Gravitational Radiation, Black Holes & Neutron Stars*
- Lectures on *The Theory of Black Holes* at the 2016 CRAQ Summer School on the astrophysics of compact objects (Montreal, QC, August 2016)
- Supervisor (leading tutorials for groups of 2-6 students) in Physics at the University of Cambridge, for 3rd year undergraduate course in *Relativity* and 4th year undergraduate course in *Relativistic Astrophysics & Cosmology*
- Research advisor for undergraduate student Tristin Rice (Stanford University, Fall 2021) and masters student Adam Gonzalez (Saint Mary's University 2015-16). Co-supervisor of vacation students Kaloian Lozanov (Cambridge, summer 2012), Sarah Spruin (Saint Mary's University, summer 2014), Caitlin Shin (Stanford, summer 2017)

Public Outreach

- Founder, co-ordinator and host of the KIPAC public lecture series at Stanford University
- Lectures given to public audiences on contemporary topics across astronomy at university and observatory open house events, astronomical societies and other settings (audiences of 10s to 100s)
- Royal Astronomical Society guest lecturer on board the ocean liner Queen Mary 2 (audiences up to 400) as part of the Cunard Insights programme
- Live planetarium shows using SkyScan DigitalSky2
- Television and radio appearances including BBC Sky at Night (UK), CTV News and Global News (Canada), abc7 News (San Francisco, USA)
- Talks given in local secondary schools (KS3, years 7-9) introducing astronomy
- Stargazing evenings for school groups, youth groups, summer schools and the general public, tours and demonstrations of modern and historical telescopes
- Editor and sound engineer for the AstroPod podcast at the Institute of Astronomy, Cambridge (2008-2011)

Experience

Technical/Astronomy

- Reduction of data from the *XMM-Newton*, *Chandra*, *Suzaku*, *NuSTAR*, and *Swift* X-ray Telescopes including spectrum and light curve extraction, grating spectra and timing analysis
- On-site observing at the *William Herschel Telescope* (WHT), La Palma – optical spectroscopy using ISIS
- Analysis of astronomical X-ray data, spectral fitting and simulation of X-ray observations in XSPEC
- Time series analysis, statistical inference, and the development of codes for X-ray spectral-timing analysis
- Analysis and reduction of astronomical images (including spectrograph data) using DS9 and IRAF

Computing

- Programming in *C*, *C++*, *Python*, *Fortran*, *Visual Basic*, *Visual C#*, *Java*, and *Perl* as well as the scientific packages MATLAB and *Mathematica*. Extensive experience in UNIX shell scripting. Development of numerical simulations and astronomical data analysis codes
- High performance computing, programming for Graphics Processing Units (GPUs) using NVIDIA CUDA, development of machine learning algorithms using TENSORFLOW and SCIKIT-LEARN
- Professional web design in HTML/CSS. Advanced scripting in PHP and experience with industry standard web content management systems. Design, use and administration of SQL databases
- Graphic design and publishing using the Adobe Creative Suite (InDesign, Illustrator, Photoshop, Acrobat)
- Administration of Linux and Windows servers (including professional web hosting servers). Network and computer administration for a research group

Selected Presentations

Invited Seminars and Colloquia

- Seeing to the Event Horizons of Supermassive Black Holes
 - *Physics Colloquium, Wayne State University, Detroit MI (February 24, 2022)*
 - *Physics Colloquium, Julius-Maximilians Universität, Würzburg (October 18, 2021)*
 - *Colloquium, South African Astronomical Observatory (September 30, 2021)*
 - *Physics Colloquium, Stanford University (September 28, 2021)*
 - *Astronomy Colloquium, The Pennsylvania State University (September 22, 2021)*
 - *SLAC Colloquium, SLAC National Accelerator Laboratory, Menlo Park, CA (May 10, 2021)*
 - *Astrophysics Colloquia, Stanford University, Stanford, CA (June 25, 2020)*
 - *INPA Seminars, Lawrence Berkeley National Laboratory, Berkeley, CA (February 23, 2018)*
 - *Physics Colloquia, University of Notre Dame, South Bend, IN (March 22, 2017)*
- Mapping the Extreme Environments around Black Holes
 - *Spitzer Seminars, California State University, East Bay, Hayward, CA (October 11, 2018)*
 - *Institute of Astronomy Seminars, University of Cambridge, UK (June 20, 2018)*
- Revealing the Dynamic X-ray Sources and Jet Launching from Black Holes
 - *CASA/JILA Astrophysics Seminars, University of Colorado, Boulder, CO (March 6, 2015)*
- Seeing to the Black Hole Event Horizon in AGN with X-ray Observations
 - *Astrophysics Seminars, University of Notre Dame, South Bend, IN (February 17, 2015)*
 - *Physics Seminars, St. Francis Xavier University, Antigonish, NS (January 23, 2015)*
 - *Physics Seminars, Mount Allison University, Sackville, NB (September 17, 2014)*
- Revealing the Dynamic X-ray Sources from Supermassive Black Holes
 - *CITA Seminars, University of Toronto (February 12, 2015)*
- X-ray reflection as a probe of accreting black holes
 - *CITA National Fellows' Meeting, University of Toronto (February 24, 2014)*
 - *Astrophysics Seminars, University of Bristol, UK (February 14, 2013)*
 - *Astronomy & Physics Colloquia, St. Mary's University, Halifax, NS (January 11, 2013)*

Selected Conference Talks

- A statistical approach to measuring X-ray reverberation in gravitationally lensed quasars
Chandra Data Science Workshop (August 19, 2021)
- The Central Engine: Observations (*invited*)
43rd COSPAR Assembly, Sydney, Australia and online (January 28-February 4, 2021)
- Identifying charged particle background events in X-ray imaging detectors with novel machine learning algorithms
SPIE Astronomical Telescopes & Instrumentation Digital Forum (December 14-18, 2020)
- Venturing Beyond the ISCO: Mapping the extreme environments around black holes
30th Texas Symposium of Relativistic Astrophysics, Portsmouth, UK (December 16, 2019)
- Venturing Beyond the ISCO: Mapping the extreme environments around black holes
JSI Workshop 'The New Faces of Black Holes,' Annapolis, MD (November 11, 2019)
- Mapping supermassive black holes with X-ray reverberation (*invited*)
17th HEAD Meeting, Monterey, CA (March 19, 2019)
- Venturing Beyond the ISCO: Probing the black hole plunging region
17th HEAD Meeting, Monterey, CA (March 20, 2019)
- Mapping the extreme environments around black holes
42nd COSPAR Assembly, Pasadena, CA (July 20, 2018)
- Revealing structure and the jet connection within AGN coronae
29th International Texas Symposium on Relativistic Astrophysics, Cape Town, South Africa (December 6, 2017)
- Beyond the lamppost: Probing the structure of the extended corona (*invited*)
16th HEAD Meeting, Sun Valley, ID (August 23, 2017)
- Revealing structure within the coronae of Seyfert galaxies
The X-ray Universe 2017, Rome, Italy (June 8, 2017)
- Flaring and jet launching from supermassive black holes
2016 NuSTAR Science Meeting, Pasadena, CA (November 16, 2016)
- Beyond the Lamppost: Lag spectra arising from extended coronae (*invited*)
Lorentz Center Workshop 'The X-ray Spectral Timing Revolution,' Leiden, The Netherlands (February 2, 2016)
- Driving extreme variability: Evolving coronae and evidence for jet launching in AGN
2015 XMM-Newton Science Workshop – The Extremes of Black Hole Accretion, Madrid, Spain (June 10, 2015)
- The evolving corona and evidence for jet launching from the supermassive black hole in Markarian 335
225th AAS Meeting, Seattle, WA (January 7, 2015)
- Driving Extreme Variability: Measuring Evolving AGN Coronae
14th AAS HEAD Meeting, Chicago, IL (August 20, 2014)
- X-ray Reflection as a Probe of Accreting Black Holes
223rd AAS Meeting, Washington DC (dissertation talk, January 9, 2014)
- Probing Accreting Black Holes with X-ray Reflection – New observational tools?
RAS National Astronomy Meeting, St. Andrews, UK (July 2, 2013) and First UK LOFT Science Meeting, RAS, London (June 24, 2013)