James Matthews

Astrophysicist

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Academic Career

2019–present **Herchel Smith Fellow**, *University of Cambridge.*

2016–2019 **Postdoctoral Researcher**, *University of Oxford.*
Project title: "The origin of ultra-high energy cosmic rays", PIs: Profs. A. R. Bell and K. M. Blundell

2012–2016 **PhD Physics**, *University of Southampton.*
Thesis: "Disc Winds Matter: Modelling Accretion and Outflow On All Scales", Supervisor: Prof. C. Knigge

2012 **Research Year Abroad**, *Harvard-Smithsonian CfA.*
Thesis: "Searching For Nearby Planets During Predicted Microlensing Events", Supervisor: Dr. R. Di Stefano

2008-2012 **MPhys Astrophysics**, *University of Southampton*, first-class honours.

Research Interests & Goals

- Unmasking the origin of the highest energy cosmic rays (CRs).
- Building models for particle acceleration and transport in magnetised plasmas.
- Studying the physics and observational signatures of accretion discs and their associated outflows.
- Understanding the connection between outflows and galaxy evolution, including the impact of CRs.
- Developing state-of-the-art radiative transfer and MHD methods to complement observations.

Programming Skills

Advanced Python, C, Fortran, git/github, travis-CI, LaTeX, OpenMPI Parallelisation, Visit.

Familiar IDL, Topcat, Bash, MCMC methods.

Astro (magneto)hydrodynamics, Monte Carlo radiative transfer, Cloudy, CRPropa, PLUTO.

Awards, Grants & Successful Proposals

2018 **LBS Proposal, co-I**, *Laboratory model of particle acceleration in Supernova shocks*, PI: Chen.

2017 **HST Proposal, co-I**, *Wide band spectra of nova-like variables*, PI: Long.

2016 **Springer Thesis Prize**, *University of Southampton.*

2015 **SALT Proposal, PI**, *The spectra of nova-like variables.*

2013 **RAS Grant**, *Visit to Columbia University.*

2008-2012 **Academic Scholarship**, *Top 5 students, University of Southampton.*

Talk Highlights

Over 25 talks at international conferences and invited colloquia in Europe, Asia, USA.

2019 **Invited Colloquium**, *University of Glasgow.*

2018 **Invited Talk**, *Hillas Symposium, Heidelberg.*

2018 **Invited Talk**, *Particle Acceleration and Transport, Calabria.*

2018 **Invited Colloquium**, *Queen's University, Belfast.*

2018 **Contributed Talk**, *UHECR 2018, Paris.*

2018 **Invited Colloquium**, *University of Manchester.*

2017 **Invited Review**, *Broadband Astrophysical Processes, Southampton.*

2017 **Invited Colloquium**, *University of Southampton.*

2017 **Contributed Talk**, *AGN Winds on the Georgia Coast, Jekyll Island, GA.*

2015 **Contributed Talk**, *TORUS 2015, Winchester.*

2015 **Contributed Talk**, *Black Hole Accretion and AGN feedback, Shanghai.*

Responsibilities and Service

2018 Undergraduate Tutor, Astrophysics C1

2018 Invited reviewer, "Particle acceleration in jets", for "100 years of jets" review anthology.

2018 Astrophysics summer project admissions and co-ordination

2018-2019 Organiser and founder, Oxford Astrophysics Outreach for the Homeless

2017-2019 SPI-MAX seminar organiser

2017-2019 Galaxies coffee organiser

2016-present Referee: ApJ, MNRAS, PASA

2017, 2018 Summer project supervisor: Ziyan Li, Andrew Sellek

2017 Local Organising Committee, Plasma Astrophysics Conference, Oxford

2012-2016 Outreach Demonstrator, University of Southampton Astrodome

2012-2016 Teaching Demonstrator, University of Southampton

Selected Publications

26 articles, 25 published or in press, 8 first-author, H-index: 9, citations: 289 (ADS) 295 (Google Scholar), *hyperlinks are given for three first-author papers, some titles abbreviated.*

First Author

2020 **Stratified disc wind models for the AGN broad-line region**.
Matthews, J.H., Knigge, C., Higginbottom, N., et al., MNRAS, in press, arXiv:2001.03625

2020 **Particle acceleration in astrophysical jets**.
Matthews, J.H., Bell. A., Blundell, K., New Astronomy Reviews, in press

2019 **Ultrahigh energy cosmic rays from shocks in the lobes of radio galaxies**.
Matthews, J.H., Bell. A., Blundell, K., Araudo, A., MNRAS, 482, 4303, hyperlink to paper.

2018 **Fornax A, Centaurus A other radio galaxies as sources of ultrahigh energy cosmic rays**.
Matthews, J.H., Bell. A., Blundell, K., Araudo, A., MNRAS Letters, 479, 76

2017 **Amplification of perpendicular and parallel magnetic fields by cosmic ray currents**.
Matthews, J.H., Bell. A., Blundell, K., Araudo, A., MNRAS, 469, 1849, hyperlink to paper.

2017 **Quasar emission lines as probes of orientation**.
Matthews, J.H., Knigge, C., Long, K. S., MNRAS, 467, 2571

2016 **Testing quasar unification: radiative transfer in clumpy winds**.
Matthews, J.H., Knigge, C., Long, K. S. et al., MNRAS, 458, 293, hyperlink to paper.

2015 **The impact of accretion disc winds on the optical spectra of CVs**.
Matthews, J.H., Knigge, C., Long, K. S. et al., MNRAS, 458, 293

Co-author

2019 **Disc wind models for FU Ori objects**.
Milliner, K., Matthews, J. H., Long, K. S., Hartmann, L., Hillenbrand, L. A., MNRAS, 483, 1663

2018 **The origin of radio emission in broad absorption line quasars: results from LoTSS**.
Morabito, L. K., Matthews, J.H., et al., A&A, in press.

2018 **Stochastic transport of high-energy particles through a turbulent plasma**.
Chen, L.E., Bott, A., ..., Matthews, J.H. et al., Submitted, arXiv:1808.04430

2018 **Radiation-hydrodynamic simulations of thermally driven disc winds in X-ray binaries**.
Higginbottom, N., Knigge, C., Long, K. S., Matthews, J. H. et al., MNRAS, 479, 3651

2018 **Cosmic-ray acceleration by relativistic shocks: limits and estimates**.
Bell. A., Araudo, A., Matthews, J.H., Blundell, K., MNRAS, 473, 2364

2018 **On the maximum energy of nonthermal particles in Cygnus A**.
Araudo, A., Bell. A., Blundell, K., Matthews, J.H., MNRAS, 473, 3500

2014 **Line-driven Disk Winds in Active Galactic Nuclei**.
Higginbottom, N., Proga, ..., Matthews, J.H. et al., ApJ, 789, 19

References

Prof. Tony Bell FRS, *University of Oxford*, tony.bell@physics.ox.ac.uk.
Connection: PI at Oxford.

Prof. Christian Knigge, *University of Southampton*, C.Knigge@phys.soton.ac.uk.
Connection: PhD Supervisor

Prof. Katherine Blundell OBE, *University of Oxford*, katherine.blundell@physics.ox.ac.uk.
Connection: PI at Oxford.

Dr. Knox Long, *STScI/Eureka Scientific*, long@stsci.edu.
Connection: Scientific collaborator and co-supervisor.