Dr David J. Turner CV

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A researcher interested in the use of galaxy clusters as astrophysical and cosmological laboratories, who also specializes in the creation of general, open-source, research software for X-ray astrophysics.

Research Positions

NASA High Energy Astrophysics Science Archive Research Center — Greenbelt, USA
Staff Scientist — 2025–**Current**

University of Maryland, Baltimore County — Baltimore, USA
Assistant Research Scientist — 2025–**Current**

Michigan State University — East Lansing, USA
Postdoctoral Research Associate — 2022–2025

Education

University of Sussex — Brighton, UK
Ph.D. in Astronomy, Advisor: Professor Kathy Romer — 2018–2022
Exploiting the XMM science archive for X-ray galaxy cluster mass calibration

University of Sussex — Brighton, UK
1st Class MPhys in Astrophysics — 2014–2018

Skills

- **X-ray Expertise:** I have extensive experience working with large amounts of X-ray data from various missions. I am very familiar with technical aspects of X-ray data and analysis, particularly for *XMM* and *eROSITA*.
- **Galaxy Cluster Science:** I am an expert in multi-wavelength analyses of large samples of clusters; constraining mass, temperature, density, and relations between them. This provides information on the scatter of the total mass with respect to these different properties; very important to successfully constrain cosmology using galaxy clusters.
- **Software Engineering:** I am a highly capable Python programmer, and very familiar with GitHub and writing tests/documentation (e.g. Daxa and Xga) - allows me to make my software sustainable and useful to the community. I also have some experience building Docker container images.
- **Team Leadership:** I lead a team of students and postdoctoral researchers to develop/maintain my software, and have provided research supervision to graduate and undergraduate students.
- **Data Science & Machine Learning:** During my PhD I pursued extra training in machine learning and data science - I have used these skills in my research, and working at a company specializing in natural language processing.

Open-Source Astrophysics Software

Xga - General X-ray Analysis
Python module to make complex analyses (e.g. spectral, radial) of X-ray data simple. Supports *XMM* & *eROSITA*, with *Chandra* in development.

Daxa - Multi-mission X-ray data archives
Python module for easy acquisition, reduction, and management of multi-mission X-ray astrophysics datasets - enabling access for non-experts.

Ongoing Research

LoVoCCS ICM Properties and Relations
LoVoCCS is creating 2D weak-lensing mass maps for 147 local clusters - I am providing X-ray properties (global, radial, & 2D maps) and scaling relations.

X-ray Masses of Galaxy Clusters
Measuring masses for the XCS catalog. We have 1000s of candidates, so automation is vital. Created the largest set of X-ray cluster masses.

Galaxy Groups Exhibiting OVI Absorption
Finding X-ray counterparts to optically-selected groups; linking X-ray properties to whether warm-phase ICM is detected by background quasar absorption.

Large-scale X-ray Analysis of LOFAR sources
Applying XGA to LOFAR catalogs to measure X-ray properties for over 10000 radio sources. A valuable catalog of radio/X-ray properties for a large sample.

Multi-wavelength Cluster Scaling Relations
Scaling relations (including MORs) using *XMM* and DES data. These feed into DES cluster cosmology efforts, and help prepare for LSST-DESC work.

Locating Pea Galaxies with Machine Learning
An ensemble approach to identifying Pea Galaxies with SVM + deep learning. Supported by NVIDIA grant. X-ray properties to be measured once sample complete.

Observing Time

- **NuSTAR:** Allocated 500 ks of *NuSTAR* time in cycle 10, and 240 ks in cycle 11, in order to search for non-thermal hard X-ray flux from early stage cluster mergers and bridges, and constrain magnetic field strengths.
- **XMM:** I was allocated ∼20 ks of *XMM* time in AO23 for a LoVoCCS cluster with no modern X-ray coverage.

Supervision and Management

- XGA & DAXA **Developer Team Leader:** A growing team is now working on the software that I created - I lead development, and now also manage the team and the overall direction of the ecosystem. I am trying to recruit more developers, in order to provide support for some large collaborations that wish to use it.
- **PhD Student Co-supervisor:** I remotely co-supervise a PhD student at the University of Sussex, helping and advising her work on galaxy cluster research and software development.
- **Supervision of Undergraduates:** I have provided research supervision for several undergraduate students; most recently a student doing her senior thesis project, and also an REU student, who has since joined our graduate school.

Time Allocation Committees

- **XRISM:** Served on one of the extra-galactic committees for the first *XRISM* general observer program.

Recent Awards

- ***NuSTAR* Phase II Funding -** $80,000 dollars to support *NuSTAR* observations 2024
- **Doctoral Open Research Prize -** £2000 in recognition of the open-source nature of my PhD thesis 2022
- **NVIDIA Academic Grant -** Quadro RTX 8000 GPU 2021
- **DISCNet-STFC PhD Studentship -** All fees, salary, and travel funding for my PhD 2018–2022

Relevant Conferences and Talks

- **Groups in eROSITA/Euclid era:** Presented results from X-ray analyses of groups with warm-phase gas.
- **The X-ray Universe:** Gave a talk on hydrostatic mass measurements of galaxy clusters using my XGA software.
- **University of Michigan:** Invited to give a talk to the galaxy cluster research group - presented on my analysis of eFEDS clusters with *XMM*, the temperature calibration that was produced, and the XGA package.
- **Michigan State University:** Gave the astrophysics seminar on uses of X-ray observations and open-source science.
- **Talk at AIfA:** Invited to give a talk to the cluster group at Argelander Institute for Astronomy. Focusing on recent work on *eROSITA-XMM* temperature calibrations and cluster mass measurements of an SDSS selected sample.
- **Talk at CfA:** Invited to give a talk to the cluster group at the Center for Astrophysics. Focusing on cluster mass measurements for an SDSS selected sample.
- **Cluster Mass 2021:** Presented a flash talk/poster on a new sample of SDSS hydrostatic masses measured by XGA.
- **LSST UK 2021 Meeting:** Presented a poster on a new sample of DES-Y3 hydrostatic masses measured by XGA.

- **National Astronomy Meeting 2021:** I organized and convened a session to bring together cluster observers and simulators. It was a great success and attracted talks on cutting edge research from many areas of cluster science.
- **Talk at MPE:** Gave a 40 minute talk to the high-energy astrophysics group at the Max Planck Institute for Extraterrestrial Physics, giving an overview of XCS with a particular focus on my cluster mass measurements.

Publications

1. D. J. Turner et al., "The XMM Cluster Survey: Automating the estimation of hydrostatic mass for large samples of galaxy clusters I – Methodology, Validation, Application to the SDSSRM-XCS sample", *submitted*
2. D. J. Turner et al., "The *XMM* Cluster Survey: An independent demonstration of the fidelity of the eFEDS galaxy cluster data products and implications for future studies", *MNRAS*
3. D. J. Turner et al., "Xga - A module for the large-scale scientific exploitation of X-ray data", *arXiv*
4. D. J. Turner et al., "Daxa - Traversing the X-ray desert by Democratising Archival X-ray Astronomy", *submitted*
5. D. J. Turner et al., "An X-ray view of galaxy groups in the line of sight of UV-bright quasars - comparing X-ray properties to absorption detection of warm-hot gas", *submitted*
6. D. J. Turner et al., "X-LoVoCCS I - X-ray properties and scaling relations of 58 clusters with individual 2D weak-lensing mass maps", *in prep., 2025*
7. D. J. Turner et al., "The XMM Cluster Survey: Automating the estimation of hydrostatic mass for large samples of galaxy clusters II – SDSSRM-XCS Mass Relations", *in prep., 2025*
8. D. J. Turner et al., "X-ray properties of all LOFAR sources with an XMM detection", *in prep.*
9. S. Fu et al., "LoVoCCS II: Weak Lensing Mass Distributions, Red-Sequence Galaxy Distributions, and Their Alignment with the Brightest Cluster Galaxy in 58 Nearby X-ray-Luminous Galaxy Clusters", *ApJ*
10. D. S. Pillay, et al., "A Multiwavelength Dynamical State Analysis of ACT-CL J0019.6+0336", *published in MDPI Galaxies* - **Supplied X-ray data products, contributed to paper, and was made second author.**
11. P. M. Kelly, et al., "Dark energy survey year 3 results: miscentring calibration and X-ray-richness scaling relations in redMaPPer clusters", *MNRAS* - **Assisted with sample construction and *XMM* analysis**.
12. P. A. Giles et al., "The *XMM* Cluster Survey: XMM-Newton Observations of the SDSS DR8 redMaPPer Cluster Catalogue", *MNRAS* - **Calculated and supplied upper limit X-ray luminosities.**
13. P. A. Giles et al., "XXL: The $L_X - \sigma_v$ relation of galaxy groups and clusters detected in the XXL and GAMA surveys", *MNRAS* - **Calculated and supplied upper limit X-ray luminosities.**
14. V. Wetzell et al., "Velocity Dispersions of Clusters in the Dark Energy Survey Y3 redMaPPer Catalog", *MNRAS* - **Calculated and supplied upper limit X-ray luminosities.**
15. C. J. Burke, et al., "Variability-Selected Dwarf AGNs in the Dark Energy Survey Deep Fields", *MNRAS* - **Supplied *XMM* confirmation of AGN, X-ray properties, contributed to text of paper.**
16. T. M. C. Abbott et al., "The Dark Energy Survey Data Release 2", *ApJ* - **On DES Observing Team**

Additional Experience

- **Outreach:** I enjoy educating the public about cutting edge research, and have been involved in outreach for DES and JWST. I helped coordinate social media coverage for the DES Y1 Cosmology release in August 2017, and co-organized/ran the DES 'end of nights' social media campaign, marking the end of our observations on DECam. I volunteered for Soapbox Science, where female researchers give talks to the public to promote women in the sciences. I have also given 'astronomy on tap' public talks, and volunteered extensively at MSU observatory open nights.
- **Data Science:** During the pandemic the Director of Student Experience for the Physics department at the University of Sussex ran surveys to gauge the mood of the student body during the autumn term. I was employed by the department to concatenate, reduce, and analyze them, so that the faculty members could understand how the students were feeling and adjust their teaching accordingly. I also worked for Madgex, in a team specializing in large-scale data-science, and the application of natural language processing to career and job information.
- **Co-founder and Director:** I co-founded a limited company called Grapheel during my undergraduate degree, though we ceased operations last year. It was a not-for-profit company trying to create technologies that would allow blind and visually impaired students/researchers to interact with their work in a more natural manner. Working on our app increased my knowledge of web-based programming languages, and I also had the chance to work with new smart materials in our work to create new actuators. My communication skills benefited from making pitches to investors (we were shortlisted for funding twice) and writing documentation for aspects of the company.