Andrew Robertson

Postdoctoral Fellow

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Academic positions

2024–present **Carnegie Observatories**, *Pasadena*, USA, Postdoctoral Fellow.
- Leading the generation of mock galaxy catalogues and contributing to pixel-level simulations for the Roman Galaxy Redshift Survey Project Infrastructure Team, directly supporting forthcoming data analysis.
- Secured telescope time and led spectroscopic observations of a strong lens with multiple background sources, gaining experience in programme design and data reduction.
- Developing methods to interpret data from a successful JWST Cycle 3 Bullet Cluster programme, including simulations of analogues to connect theory with observations.

2021–2024 **Jet Propulsion Laboratory, Caltech**, *Pasadena*, USA, JPL Postdoc.
- Combined weak lensing and redshift-space distortions around galaxy clusters to test gravity
- Implemented the calculation of data vectors and covariance matrices, as well as redshift-space distortion theory modules, for JPL's joint analysis pipeline for large scale structure data
- Software development for Pseudaria, a tool to detect and correct for unknown systematics in large survey data, applied to real cosmology datasets.
- Modelled dust effects in simulated galaxies to improve comparison with observed spectra.
- Investigated the use of galaxy cluster shapes measured by the SuperBIT telescope to constrain dark matter properties.

2017–2021 **Institute for Computational Cosmology**, *Durham*, UK, Postdoctoral Research Associate.
- Ran and analysed cosmological simulations of systems ranging in mass from dwarf galaxies up to galaxy clusters, with self-interacting dark matter and baryonic physics.
- Produced ray-tracing code to generate mock gravitational lensing data from simulations.
- Worked on analytical modelling of the density profiles of self-interacting dark matter haloes and how they respond to the presence of baryons.
- Made weak lensing mock catalogues for the Euclid 'Enabling weak lensing cosmology' project

Education

2013–2017 **Department of Physics**, *Durham University*, PhD in Astrophysics.
- Incorporated particle physics phenomenology into Cosmological simulations of dark matter.
- Performed analytical calculations of dark matter self-interaction rates through cosmic time.
- Simulated Bullet Cluster-like systems with self-interacting dark matter.
- Cosmological zoom simulations of galaxy clusters with hydrodynamics and self-interacting dark matter.

2009–2013 **Selwyn College, University of Cambridge**, Master of Natural Science in Experimental and Theoretical Physics.
- MSci & BA(Hons), Class 1
- Masters Thesis: Fast Simulation of Atmospheric Phase Screens for Adaptive Optics

Awards and Prizes

2018 Alan Martin Doctoral prize for the best PhD thesis in Physics (Durham University)

2010–2013 Academic Scholarship from Selwyn College, Cambridge

2013 Siddans Prize for Physics (Selwyn College)

2012 Braybrook Prize for Physics (Selwyn College)

2010 Tripos Prize for Natural Science (Selwyn College)

Collaborations

2025–present **The THREE HUNDRED project**.
Designed a spin-off project to simulate Bullet Cluster analogues using the THREE HUNDRED infrastructure. Now supervising two PhD students who are implementing this.

2024–present **The Roman Galaxy Redshift Survey Project Infrastructure Team**.
Improved the calibration of the Galacticus semi-analytic model. Now using this improved model to simulate a population of galaxies with which I am generating pixel-level mock Roman grism images.

2023–present **NASA's OpenUniverse**.
Created a dust model to post-process galaxy catalogues from semi-analytic models

2021-present **Darkium**.
Supervising the development of a code for cosmological simulations with non-standard dark matter models, which will soon be publicly released.

2021-2024 **SuperBIT**.
Assessed the suitability of the SuperBIT balloon-borne telescope for measuring dark matter properties, and supervised the generation of mock SuperBIT weak lensing data.

2020-2025 **Novel Probes of Cosmology**.
Co-wrote a review article on self-interacting dark matter.

2020-2022 **Enabling Weak Lensing Cosmology**.
Performed weak lensing calculations for the P-Millennium simulation and ran the collaboration Twitter.

2018-2021 **BUFFALO Survey**.
Consulted on methods to constrain dark matter properties, including forecasting the expected constraint from using different analysis strategies.

2015–2021 **The Virgo Consortium**.
Developed code to simulate self-interacting dark matter cosmologies. Ran and analysed hydrodynamical simulations of systems ranging from dwarf galaxies to galaxy clusters.

Funding and resources

Nov 2024 PI awarded 3.5 nights on the Magellan Telescope (market value ~$85,000 per night)

Sep 2024 Science PI for JWST Bullet Cluster simulations project ($64,416)

Feb 2024 Co-I of JWST Bullet Cluster project - leading particle physics interpretation and comparison to mock data (25 JWST-hours)

Jun 2023 Mentor for Caltech Summer Undergraduate Research Fellowship ($8,000)

2019/2020 DiRAC 2.5x computing time to run SIDM simulations (1.5M CPU hours)

May 2019 Lindau Foundation Award for 69th Lindau Nobel Laureate Meeting (~£1,500)

Feb 2019 Cosmology and Astroparticle Student and Postdoc Exchange Network travel grant (£1,150)

May 2018 Co-I for HST BUFFALO Survey (160 HST-hours and £563,000)

Teaching and Supervision

Postgraduate supervision

2025-present **Jeisson Pulido**, *University of Southern California*, PhD.
Simulating high-redshift galaxy formation in the JWST era

2024-present **Jimmy Wen**, *University of Southern California*, PhD.
Simulating Bullet Cluster analogues

2024-present **Kassidy Kollmann**, *Princeton University (supervised remotely)*, PhD.
Measuring the internal structure of dark matter halos with strong lensing

2021-present **Adam Smith-Orlik**, *York University (supervised remotely)*, PhD.
Modeling the anisotropic effects of self-interacting dark matter

2018-2022 **Ellen Sirks**, *Durham University*, PhD.
The dynamics of self-interacting dark matter in galaxy clusters

2018-2022 **Qiuhan He**, *Durham University*, PhD.
Constraining the dark matter particle mass through galaxy-galaxy strong gravitational lensing

2020-2022 **Moritz Fischer**, *Hamburg University (supervised remotely)*, PhD.
Simulations of Dark Matter with Frequent and Rare Self-Interactions

2017-2020 **Jack Richings**, *Durham University*, PhD.
The influence of baryons on dark matter halos: A cosmic tale of stripping, destruction, and statistics

Undergraduate supervision

2023 **Anya Mischel**, *Caltech*, SURF summer student.
Realistic mock data for the SuperBIT balloon-borne telescope

2018-2019 **Michael Sleeman**, *Durham University*, Integrated MPhys.
Modeling the dynamics of a cycling peloton

Postgraduate teaching

Aug 2021 **EXPLORE Summer School: Astrophysical laboratories of DM**.
Lectured on cosmological simulations and how we can use them to learn about dark matter

Undergraduate teaching

2025 **Galaxies and Large-Scale Structures in the Universe**, *USC*, ASTR 422.
Guest lecturer

2014-2021 **Foundations of Physics**, *Durham University*, 1st year.
Tutorial leader

2016-2018 **Planets and Cosmology**, *Durham University*, 3rd/4th year.
Problem class demonstrator

Conference Talks and Seminars

I have delivered over a dozen invited talks at leading institutions and international meetings across Europe and the US, reflecting the international recognition of my research. These invitations build on a strong record of contributed presentations, including talks at major conferences such as the UK National Astronomy Meeting and the European Week of Astronomy and Space Science, as well as regular presentations within the Virgo Consortium. I was awarded the prize for Best Long Talk at the Durham–Edinburgh DEX meeting (2017). Beyond formal presentations, I enjoy attending conferences, discussing my work, and engaging with colleagues at both large international meetings and smaller specialised workshops. A list of invited talks is provided below.

Oct 2025 **STRAND Seminar**, *University of California San Diego*, California, USA.
Calibrating Galaxy Formation Models for the Roman Era

Jan 2025 **CosmoLab Seminar**, *University of Southern California*, California, USA.
Lensing constraints on the nature of dark matter: the good, the bad and the ugly

May 2024 **SoCalDM**, *UC Riverside*, California, USA.
How much should we trust cluster-substructure constraints from strong lensing?

June 2023 **LSS meeting**, *The Royal Observatory*, Edinburgh, UK.
Modelling small-scale galaxy clustering in redshift-space

April 2023 **CCAPP Seminar**, *The Ohio State University*, Ohio, USA.
Trying to understand the dark stuff

Jan 2023 **SCIPP Seminar**, *UC Santa Cruz*, California, USA.
Trying to understand the dark stuff

Aug 2022 **Durham Astronomy Seminar**, Durham, UK.
Trying to understand the dark stuff

Nov 2021 **WE-Heraeus Seminar: Dark Matter**, *The Royal Society*, London, UK.
Self-interacting dark matter

Oct 2021 **Cosmology and astronomy seminar**, UC Davis, USA.
Probing the nature of dark matter with galaxy clusters

May 2021 **ITP Cosmology Seminars**, Heidelberg University, Germany.
Probing the nature of dark matter with galaxy clusters

Oct 2020 **Sussex Seminar**, University of Sussex, UK.
Probing the nature of dark matter – from dwarf galaxies to galaxy clusters

Feb 2020 **Oxford Cosmology Seminar**, University of Oxford, UK.
Probing the nature of dark matter – from dwarf galaxies to galaxy clusters

Nov 2019 **The First Shanghai Assembly on Cosmology and Galaxy Formation**, Shanghai, China.
Constraints on self-interacting dark matter from galaxy clusters

Oct 2019 **Competing Structure Formation Models**, Reykjavik, Iceland.
Constraints on self-interacting dark matter from galaxy clusters

Feb 2019 **UCI Seminar**, *UC Irvine*, California, USA.
Placing constraints on self-interacting dark matter using galaxy clusters

Oct 2018 **BUFFALO Meeting**, Marseille, France.
Observable tests of self-interacting dark matter in galaxy clusters

May 2018 **MSSL Seminar**, Surrey, UK.
Strong and weak lensing signals from self-interacting dark matter clusters

Mar 2018 **Unravelling the dark matter mystery**, Durham, UK.
Simulations (Self-interacting Dark Matter)

Aug 2017 **SIDM Workshop**, *Niels Bohr Institute*, Copenhagen, Denmark.
What Does the Bullet Cluster Tell us about Self-Interacting Dark Matter?

Jun 2015 **Dark Matter UK**, Liverpool, UK.
Probing Dark Matter Self-Interactions with Cosmological Particle Colliders

Journal Referee

2023–present Science
2023–present The Astrophysical Journal
2022–present Journal of Cosmology and Astroparticle Physics
2019–present Astronomy & Astrophysics
2017–present Monthly Notices of the Royal Astronomical Society
2016–present Physical Review: Letters, X, D

Outreach

Television and radio

Apr 2018 **The Today Programme**, *BBC Radio 4*, UK.
Interviewed by John Humphrys

Apr 2018 **Good Evening Wales**, *BBC Radio Wales*, UK.
Interviewed by Felicity Evans and Peter Johnson

Apr 2018 **Good Morning Scotland**, *BBC Radio Scotland*, UK.
Interviewed by Gary Robertson

Jan 2018 **The Sky at Night - The Invisible Universe**, *BBC Four*, UK.
Featured a video of one of my Bullet Cluster simulations

Apr 2017 **Strip the Cosmos - Mystery of the Hidden Universe**.
Featured a video of one of my Bullet Cluster simulations

YouTube

Jun 2022 **The Absurd Search For Dark Matter**, *Veritasium*, 10 million views.
Featured my Bullet Cluster simulations

Talks

Jan 2026 **Carnegie Observatories**, CA, USA.
Lunch with an Astronomer

Nov 2025 **Glendale Community College Planetarium**, CA, USA.
A Conversation with the Stars

May 2025 **Pasadena City College**, CA, USA.
Shining a Light on Dark Matter

April 2019 **Cranleigh School**, Surrey, UK.
What we know we don't know about Dark Matter

May 2017 **Pint of Science**, Durham, UK.
Cosmic Particle Colliders

Oct 2016 **Durham University Physics Society**, Durham, UK.
Shining a Light on Dark Matter

Jun 2016 **Three Minute Thesis Regional Finals**, Newcastle University, UK.
Sticky Dark Matter

Nov 2015 **Southmoor Academy**, Sunderland, UK.
Shining a Light on Dark Matter

Oct 2015 **Hatfield College Research Symposium**, Durham, UK.
Shining a Light on Dark Matter

Dec 2014 **Whitley Bay High School**, Whitley Bay, UK.
A Journey Through the Cosmos

Events

November 2025 **City of Astronomy**, *Pasadena Convention Center*, California, USA.
Scale of the solar system

October 2024 **Open House**, *Carnegie Observatories*, California, USA.
Ask an Astronomer

October 2022 **Family Day**, *Jet Propulsion Laboratory*, California, USA.
Astrophysics Exhibit

April 2019 **OxNet Easter School**, *Ogden Centre*, Durham, UK.
Building Fake Universes

June 2017 **Cosmic Collisions**, Sanquar, UK.
Galaxy Makers

Nov 2016 **This is Durham, Place of Light**, Durham Cathedral, UK.
Galaxy Makers

Jul 2016 **Royal Society Summer Science Exhibition**, London, UK.
Galaxy Makers

Apr 2016 **School Science Festival**, Durham, UK.
Beyond the Rainbow

Jan 2016 **Durham University Space Day**, Durham, UK.
Building a Mars Lander

Nov 2015 **Music of Light Exhibition**, *Trevelyan College*, Durham, UK.
Gravitational Lensing Demonstration

Oct 2015 **Celebrate Science**, *Palace Green*, Durham, UK.
Bend it Like Einstein