Ellen SIRKS

PhD in Astrophysics

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Education

2018 - 2022	PhD in Astrophysics Supervisors: Prof. Richard Massey, Prof. Carlos Frenk		Durham University
2013 - 2018	MPhys with Honours Astrophysics	(First)	The University of Edinburgh

Employment

2022 - Present	Research Associate	The University of Sydney

Research

2022 - Present
Postdoc

The University of Sydney and the Australian Research Council Centre of Excellence for Dark Matter Particle Physics

- Member of the Astroparticle physics group headed by Prof. Céline Bœhm.
- Part of the dark matter working group and observing team of the Hector Survey.
- Member of the SuperBIT telescope collaboration.
- Constraining the self-interacting dark matter cross-section using dark matter - galaxy offsets in simulated merging galaxy clusters.
- Studying dark matter - baryon interactions with simulated galaxy clusters.
- Investigating the effect of dark matter self-interactions on the inter-cluster light in simulated galaxy clusters.
- Using machine learning to paint luminous red galaxies within large volume dark matter only simulations and comparing the results with halo occupation distribution (HOD) models.
- Analysing the gravitational lensing properties of the galaxy clusters observed by SuperBIT.
- Assisted with the 2024 SuperBIT science flight. Integrated the Data Recovery System (DRS), a toolkit to retrieve data from stratospheric balloon platforms, with the telescope.

2018 - 2022
PhD

Institute for Computational Cosmology, Durham University

- Explored the effects of dark matter self-interactions on the mass loss of galaxies in galaxy clusters.
- Created a test for probing the self-interaction cross-section using the high mass normalisation of the stellar-to-mass halo relation that can be performed with future surveys.
- Ran hydrodynamical cosmological simulations with dark matter self-interactions.

- Led the design of the model predicting the landing sites of the DRS.
- Designed the casings for the DRS using 3D CAD software.

2017 Summer — The Royal Society of Edinburgh

- Studied selection effects related to removing close neighbours in shape measurements for weak lensing studies.
- Awarded with the Cormack Undergraduate Vacation Scholarship.

2016 Summer — The European Organization for Nuclear Research (CERN) Summer Student Programme

- Studied *CP* violation in baryon decays based on collision data collected with the LHCb detector.
- Presented the research to the LHCb collaboration, and was shortlisted for the Moritz Karbach Prize.

2013 - 2018 — The University of Edinburgh

Undergraduate and Master's

- Tested and calibrated photomultiplier tubes that have since been implemented in the LUX-ZEPLIN experiment.
- Prepared samples of microbes for the 500-year microbiology experiment.

Scientific Contributions

First Author Papers

Sirks et al., 2024, *Hydrodynamical simulations of merging galaxy clusters: giant dark matter particle colliders, powered by gravity,* MNRAS, **530**(3), 3160 - 3170

Sirks et al., 2023, *Data Downloaded via Parachute from a NASA Super-Pressure Balloon*, Aerospace, **10**(11), 960

Sirks et al., 2022, *The effects of dark matter self-interactions on the mass stripping of cluster satellites,* MNRAS, **511**(4), 5927 - 5935

Sirks et al., 2020, *Download by Parachute: Retrieval of Assets from High Altitude Balloons,* JINST, **15**, P05014

Collaborations

Voyer et al., 2024, *From SuperBIT to GigaBIT: Informing next-generation balloon-borne telescope design with Fine Guidance System flight data,* preprint arXiv:2407.10103

Gill et al., 2024, *SuperBIT Superpressure Flight Instrument Overview and Performance: Near-diffraction-limited Astronomical Imaging from the Stratosphere,* AJ, **168**(2), 85

Etherington et al., 2024, *Strong gravitational lensing's `external shear' is not shear,* MNRAS, **531**(3), 3684 - 3697

McCleary et al., 2023, *Lensing in the Blue II: Estimating the Sensitivity of Stratospheric Balloons to Weak Gravitational Lensing*, AJ, **166**, 134

Shaaban et al., 2022, *Weak lensing in the blue: a counter-intuitive strategy for stratospheric observations,* AJ, **164**, 6

LHCb Collaboration et al., 2022, *Observation of the suppressed* $\Lambda_b^0 \to DpK^-$ *decay with* $D \to K^+\pi^-$ *and measurement of its CP asymmetry*, Phys. Rev. D, **104**(11), 112008

Gill et al., 2020, *Optical night sky brightness measurements from the stratosphere,* AJ, **160**, 266

Romualdez et al., 2020, *Robust diffraction-limited NIR-to-NUV wide-field imaging from stratospheric balloon-borne platforms -- SuperBIT science telescope commissioning flight & performance*, Review of Scientific Instruments, **91**, 034501

Hernois-Déraps et al., 2018, *Cosmological Simulations for Combined-Probe Analyses: Covariance and Neighbour-Exclusion Bias*, MNRAS, **481**(1), 1337 - 1367

Cockell et al., 2015, *The 500-year microbiology experiment,* Astronomy & Geophysics, **56**(1), 1.28 - 1.29

Talks & Seminars

2024 November	Centre of Excellence for Dark Matter Particle Physics Annual Meeting: 'Galaxy clusters: giant dark matter particle colliders'
2024 August	Macquarie University MQAAAstro Seminars: 'Galaxy clusters: giant dark matter particle colliders' *Invited*
2024 May	Australian National University Physics Seminars: 'SuperBIT: A low-cost balloon-borne telescope to rival Hubble' *Invited*
2023 August	Sydney Institute for Astronomy Seminars: 'SuperBIT: A low-cost balloon-borne telescope to rival Hubble' *Invited*
2023 July	Astronomical Society of Australia Annual Science Meeting: 'Galaxy clusters: giant dark matter particle colliders'
2023 May	The University of Melbourne Theoretical Particle Physics Seminars: 'Galaxy clusters: giant dark matter particle colliders' *Invited*
2022 December	The Dark Side of the Universe: 'Merging clusters as a testbed for self-interacting dark matter'
2022 November	ARC Centre of Excellence for Dark Matter Particle Physics Annual Meeting: 'Merging clusters as a testbed for self-interacting dark matter'
2022 June	Sydney Consortium for Particle Physics and Cosmology Seminars: 'Self-interacting dark matter and mass stripping of cluster galaxies' *Invited*
2022 June	Korean Astronomy and Space Science Institute: 'Self-interacting dark matter and mass stripping of cluster galaxies' *Invited*
2022 January	Durham-Edinburgh eXtragalactic Workshops XVIII: 'Constraining dark matter self-interactions with galaxy cluster shapes' *Won best short talk*
2021 May	The University of Edinburgh Experimental Particle Physics Seminars: 'Self-interacting dark matter and mass stripping of cluster galaxies'
2021 January	Durham-Edinburgh eXtragalactic Workshops XVII: 'DM Loss in Simulated CDM & SIDM Clusters' *Won best short talk*

Committee Roles

2023 June - 2024 June	Early career researcher (ECR) representative on the research committee of the Australian Research Council Centre of Excellence for Dark Matter Particle Physics. Organised the 2023 ECR workshop.

Outreach

2024 November	Science Extension Mentor I am a mentor providing support for five students during their final year of high school research course.
2024 August	National Quantum and Dark Matter Road Trip The Road Trip is a travelling science show focussed on quantum physics and dark matter. I provided support during the demonstration day in Sydney. Aimed at families.
2024 August	Dark Matter in the Pub Through a series of short talks and demos, seven researchers including myself explained the concept of dark matter to the public in a pub during National Science Week.
2024 April	Shirtloads of Science Podcast Dr Karl's podcast on interesting and weird science. I did an episode on my work on the data retrieval package for SuperBIT.
2024	STEMPals STEMpals connects Australian grade 5 and 6 students to STEM professionals through a pen pal program. I am in contact with one student.
2024 February	DeadlyScience DeadlyScience provides STEM resources that connect schools to the First Scientists of Australia Aboriginal and Torres Strait Islander people. I regularly provide support during their events.
2023 November and December	Skype a Scientist Skype a Scientist has a database of thousands of scientists and helps them connect with classrooms, families, libraries etc. all over the globe. I have spoken with two classrooms.
2023 August	National Quantum and Dark Matter Road Trip The Road Trip is a travelling science show focussed on quantum physics and dark matter. I provided support during the public lecture and demonstration day in Sydney. Aimed at families.
2021 June - August	Summer Science Exhibition 2021 I set-up the website hosting the online activities for the astronomy department at Durham University.

2020 January	International Space and Language Challenge
	I was the science lead. This included supporting and advising students on aspects of STEM. The event is aimed at secondary school pupils.
2019 March	Palace of Science
	I demonstrated the Galaxy Makers exhibit to the public. This exhibit allows participants to make holographic galaxies, run computer simulations and take a VR tour of the cosmos. Palace of Science is a science festival aimed at an adult audience who normally would not engage with science.
2018 and 2019 June	Celebrate Science
	I demonstrated the Galaxy Makers exhibit. Celebrate Science is a three-day Durham University Science Festival aimed at families.
2018	Changing cosmic perceptions
	I assisted with the workshops for primary school pupils combining scientific experiments and artistic challenges. The aim of this project was to shape the artwork for the astronomy building.

Teaching

2023	Supervisor for two undergraduate students for a 10-week project
2021 - 2022	Theoretical Physics 2 - Workshop Demonstrator
2019 - 2021	Introduction to Astrophysics - Marker
2018 - 2019	Maths Toolkit - Workshop Demonstrator

Languages

Dutch	Native language
English	Excellent fluency
French, German, Spanish	Basic knowledge

Computer

I routinely write programs in Python, and I am familiar with C/C++ as well as HTML and CSS. Familiar with simulation codes Gadget, SWIFT, and GIZMO. Experience with Monte Carlo modelling. Familiar with Arduino and 3D CAD software. Familiar with the Linux operating system and the TEX environments.