

Charlie Mpetha

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RESEARCH EXPERIENCE

University of Waterloo Study Abroad Project Sep 2023 - Sep 2024

- Title: ‘**Prospects for using the infall region to probe cosmology**’.
- Using dark matter simulations to test the cosmological dependence of the infall region of galaxy clusters.
- Evaluating the observability of this novel probe in the weak lensing surveys *Euclid* and *UNIONS*.

University of Edinburgh PhD Sep 2020 - Mar 2025

- Title: ‘**Weak lensing of gravitational waves**’.
- Developing the statistical methods for cosmological analyses using the weak lensing of gravitational waves.
- Investigating the bias on reconstructed cosmological parameters due to weak lensing.

Liverpool John Moores University Masters Project May 2020 - Sep 2020

- Title: ‘**Investigating Gravitational Redshifting in SPIDERS Galaxy Clusters**’.
- Using X-ray selected galaxy clusters and spectroscopically observed galaxies to measure the effect of gravitational redshifting on the observed galaxy velocity distribution in stacked galaxy clusters.

Lancaster University Masters Project Oct 2018 - May 2019

- Title: ‘**The Dynamics of a Novel Oscillating Scalar Field Dark Energy**’.
- Researched the potential for observing features of a novel dark energy model, ‘Sharp Transition Scaling Quintessence’, using the future satellites *WFIRST* and *Euclid*.

Royal Observatory, Edinburgh Summer Internship Jul 2018 - Sep 2018

- Title: ‘**Investigating Galaxy Blending in Weak Lensing Shear Measurements**’.
- Achieved project goal of quantifying the shear measurement bias caused by blended galaxies.

EDUCATION

University of Edinburgh Sep 2020 - Mar 2022

- PhD with taught courses.

Liverpool John Moores University Sep 2019 - Aug 2020

- **1st class (Summa Cum Laude) MSc** in Astrophysics (Distance learning).

Lancaster University Oct 2015 - Jun 2019

- **1st class (Summa Cum Laude) MPhys** in Particle Physics and Cosmology.

PUBLICATIONS

The infall region as a complementary probe to cluster abundance

Mpetha C. T. et al. 2024, MNRAS, 10.1093/mnras/stae1637

Constraining cosmological parameters using the splashback radius of galaxy clusters

Haggar R., Amoura Y., Mpetha C. T. et al. 2024, Accepted to ApJ.

Impact of weak lensing on bright standard siren analyses

Mpetha C. T. et al. 2024, PRD, 10.1103/PhysRevD.110.023502.

Future prospects of testing extensions to Λ CDM through the weak lensing of gravitational waves

Mpetha C. T. et al. 2023, PRD, 10.1103/PhysRevD.107.103518.

Gravitational redshifting of galaxies in the SPIDERS cluster catalogue

Mpetha C. T. et al. 2021, MNRAS, 10.1093/mnras/stab544.

AWARDS AND FUNDING

2023 Leverhulme Study Abroad Scholarship

£23,040 over one year.

For students to study or undertake research at a centre of learning in any country except the UK or USA.

2023 3rd Year Poster Prize

Awarded by The University of Edinburgh for 1st in a 3rd Yr physics graduate student poster competition.

2019 Research Academy Prize

Awarded by Lancaster University for having one of the top three masters project grades in the year.

2019 Outstanding Final Year Performance

Awarded by Lancaster University for having one of the top four overall grades in the final year.

2018 Cormack/Piazzzi Vacation Research Scholarship

£266 per week for six weeks.

The scholarships allow undergraduate students studying astronomy, who have a class record indicative of good research potential, the opportunity to further their skills and experience by undertaking a period of research over the summer holiday period.

PRESENTATIONS

Cosmological and Astrophysical Synergies: Tactics for the Latest Era

September 2024, Tagliolo Monferrato, Italy.

University of Maryland

Visiting speaker. August 2024, Maryland, USA.

Cosmology from Home

June 2024, Online conference.

UNIONS Collaboration - Invited Talk

Presented at the UNIONS collaboration weak lensing bi-annual meeting. February 2024 & June 2024, Online.

American Astronomical Society Annual meeting

January 2024, New Orleans, USA.

LISA Collaboration - Invited Talk

LISA collaboration community meeting. January 2023, Online.

Durham-Edinburgh eXtragalactic Workshop XIX

January 2023, Edinburgh, UK.

Probing the Universe with Multimessenger Astrophysics

September 2022, Sestri-Levante, Italy.

UK Cosmology Meeting

May 2022, Newcastle, UK.

Posters

CASCA, GWPAW, SUPA Annual Gathering, Tonale Winter School (received poster prize).

TEACHING AND MENTORSHIP

Summer Student Mentor

July - August 2024

- Mentored a high school student on a project visualising simulated galaxy clusters.

Teaching Assistant

Oct 2020 - Present

- Courses: Cosmology (MSc), Introductory Astrophysics, Modern Physics, Physics 1A+1B (BSc).

- Nominated for *Student Tutor of the Year* in the 2022 Student-Led Teaching Awards.

Maths and Physics Tutor

Dec 2019 - Sep 2023

- Tutored school students from ages 11 – 18, and adults, on a range of topics in Maths and Physics.

COLLABORATIONS

Euclid Collaboration

Active in the galaxy clusters science working group.

UNIONS Collaboration

Leading a project using UNIONS weak lensing profiles of galaxy clusters for cosmological constraints.

LEADERSHIP AND SERVICE

Large Scale Structure Journal Club

Organised and chaired a weekly cosmology journal club at the University of Edinburgh for over a year.

Highland graduate student conference volunteer

Organised team-building activities at a conference for University of Edinburgh graduate students.

REFEREES

Dr Giuseppe Congedo

PhD Supervisor

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Prof Andy Taylor

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