

Gravitational Lensing

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Cosmology



Durham
Centre for
Extragalactic
Astronomy



Durham
University

My Background

2015-2019: MSci in Physics - Imperial

2019-2023: PhD in Physics and Astronomy - UCL

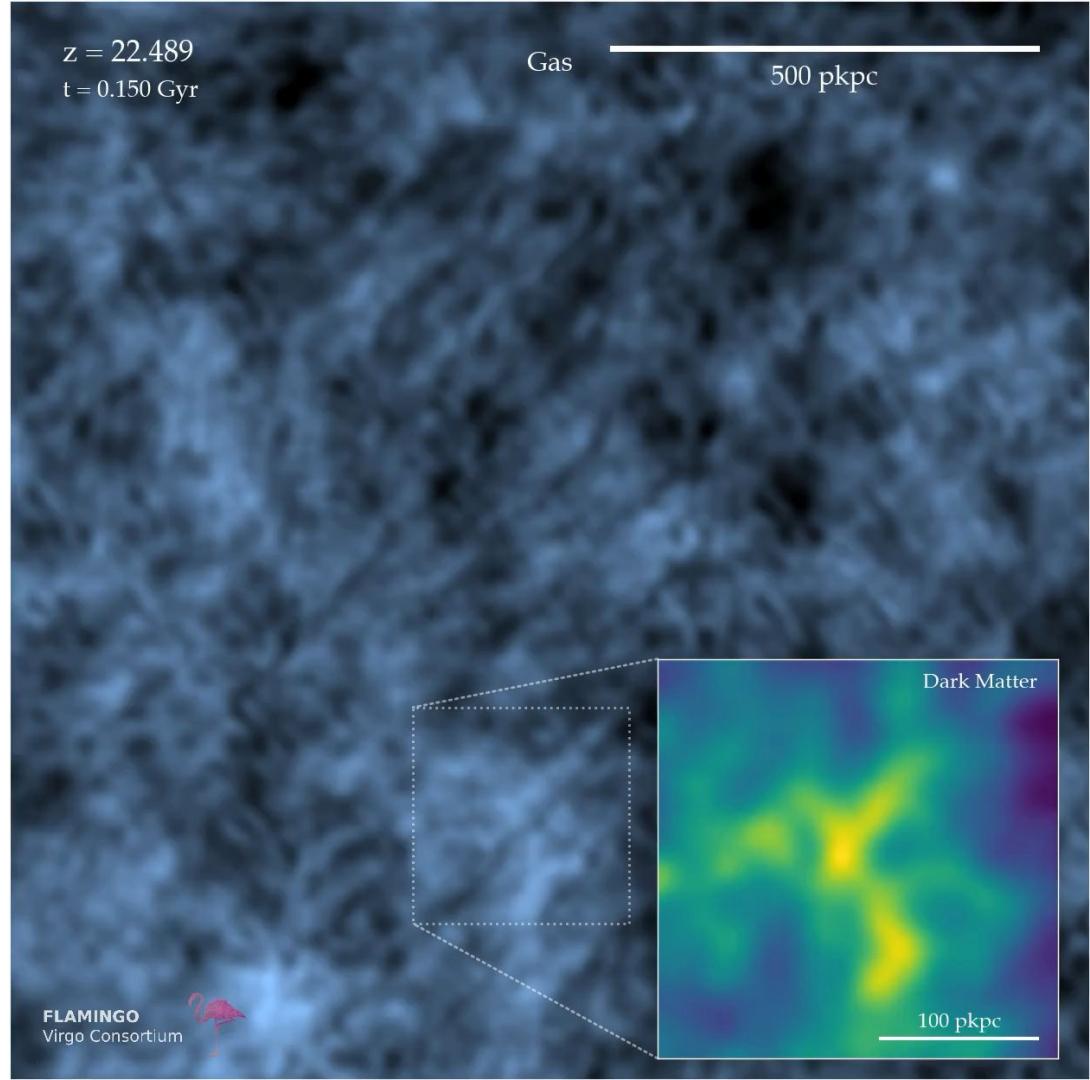
2023-2024: Postdoc - UCL

2024-Now: Postdoc - Durham



My Research: Cosmology, Gravity & Dark Matter

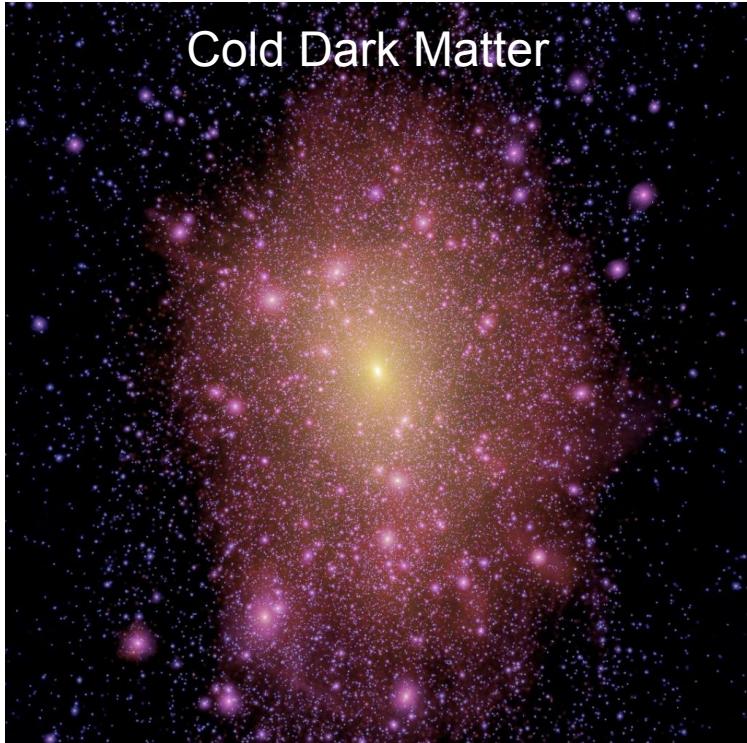
Structure formation
at the cosmological
scales



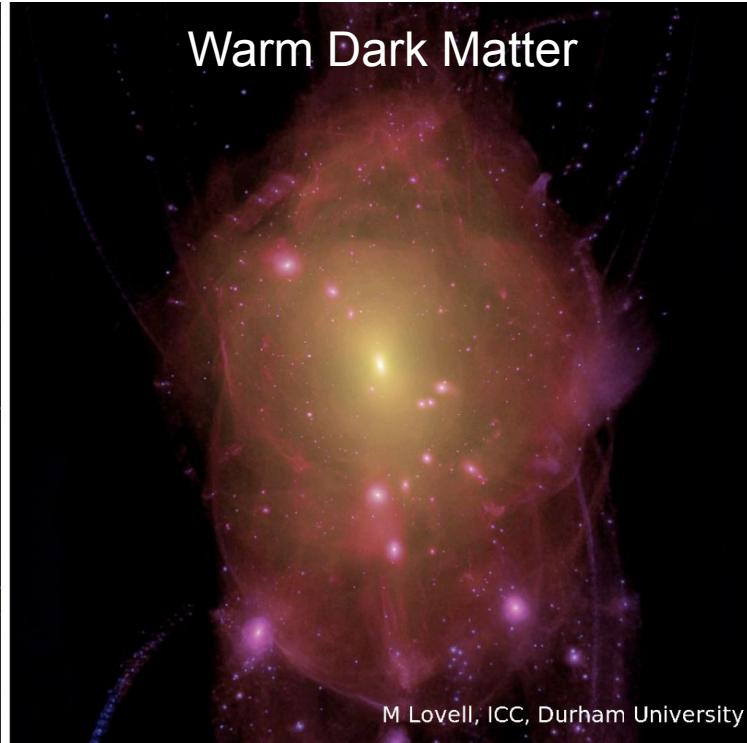
My Research: Cosmology, Gravity & Dark Matter

Structure formation at galactic scales (substructure)

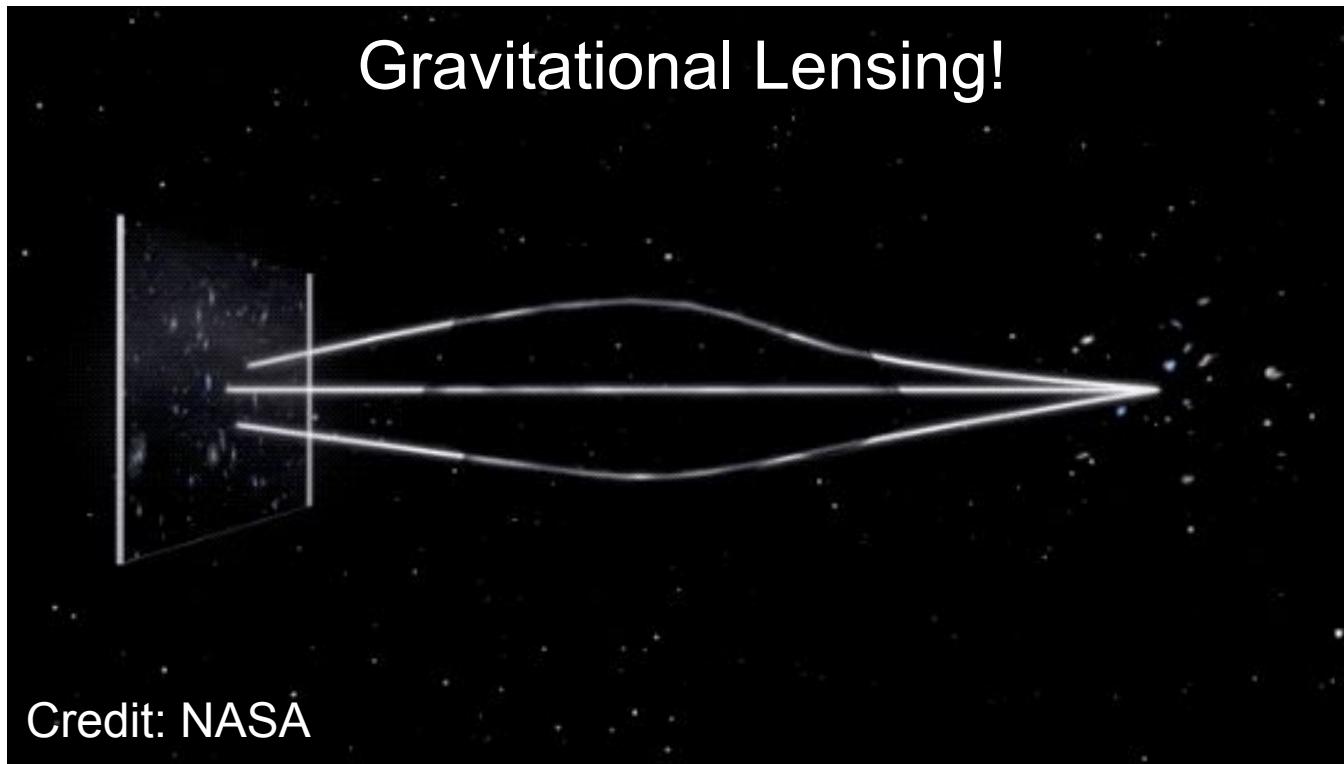
Cold Dark Matter



Warm Dark Matter



How do you see invisible matter?



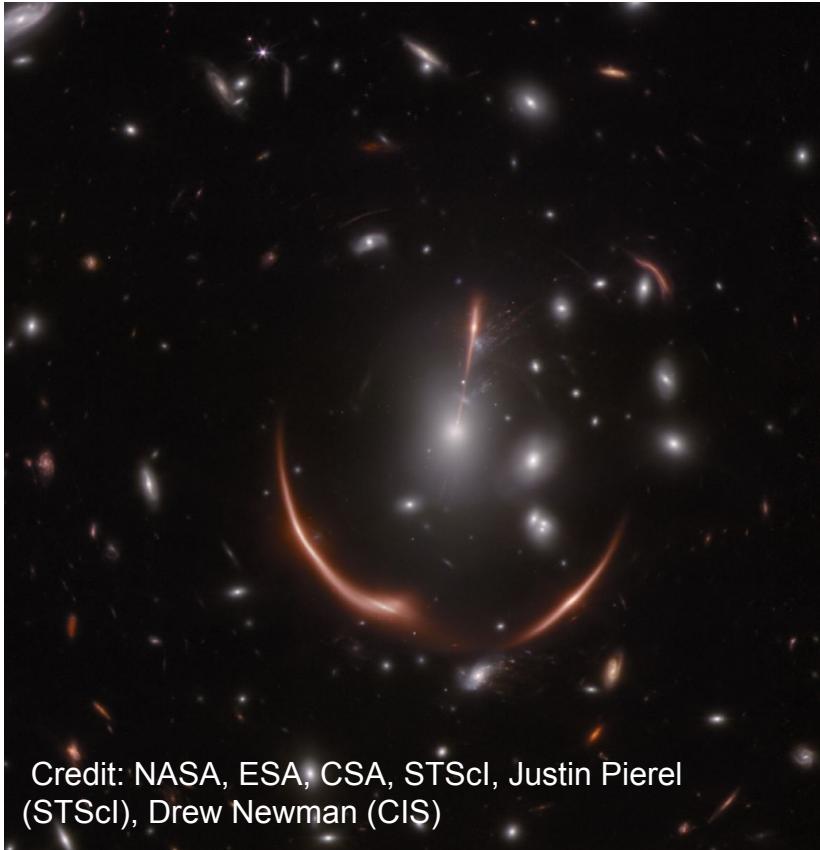


Seeing the Universe through the Gravitational Lens



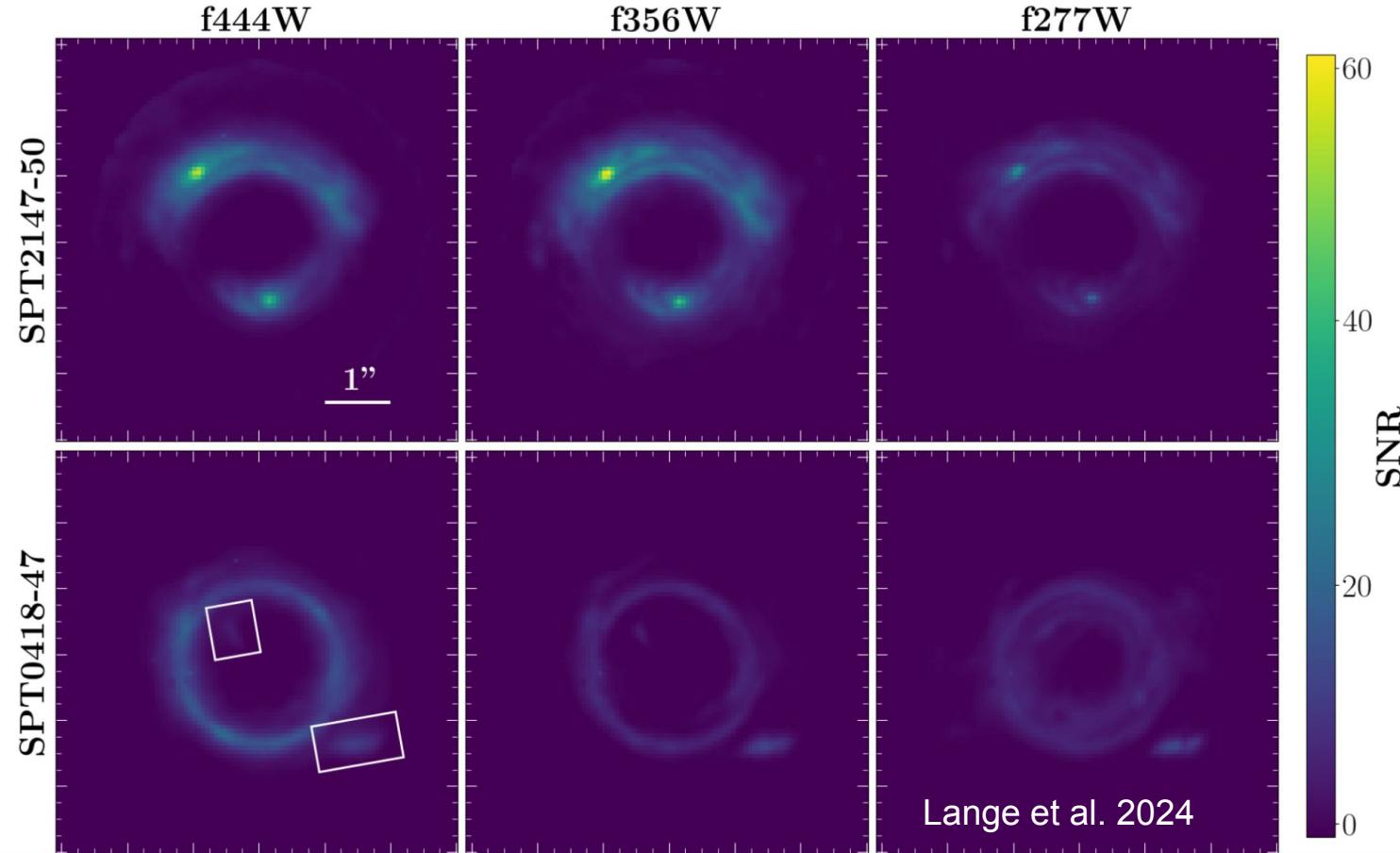
Seeing the Universe through the Gravitational Lens

NASA/ESA/CSA
James Webb Space
Telescope



Credit: NASA, ESA, CSA, STScl, Justin Pierel
(STScl), Drew Newman (CIS)

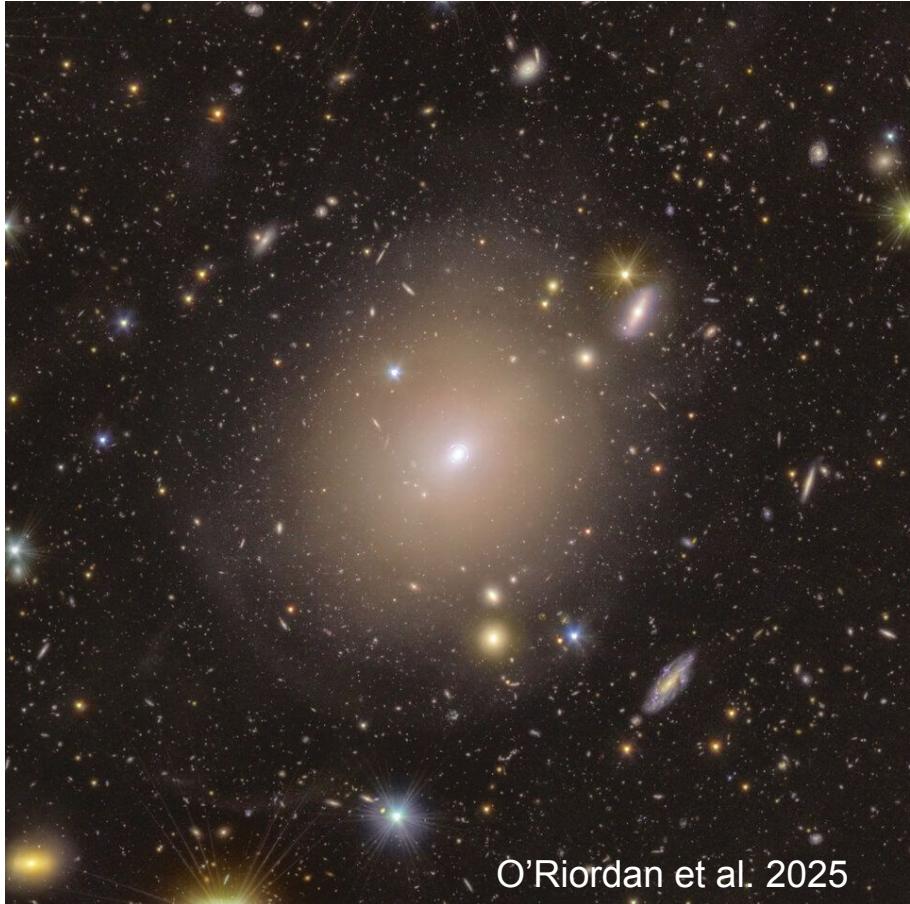
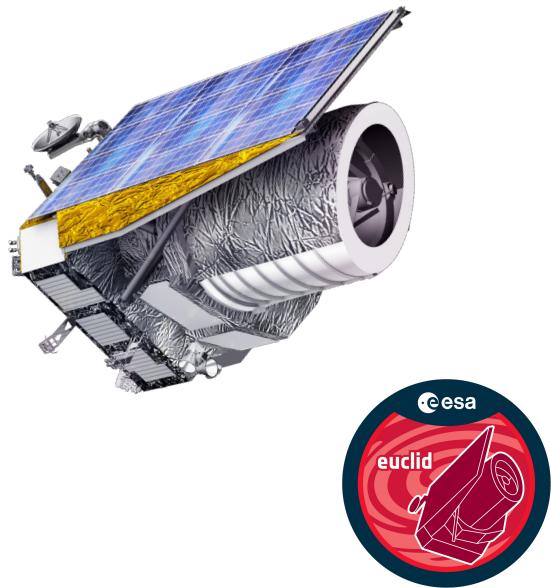
Substructure Search with JWST



Lange et al. 2024

Seeing the Universe through the Gravitational Lens

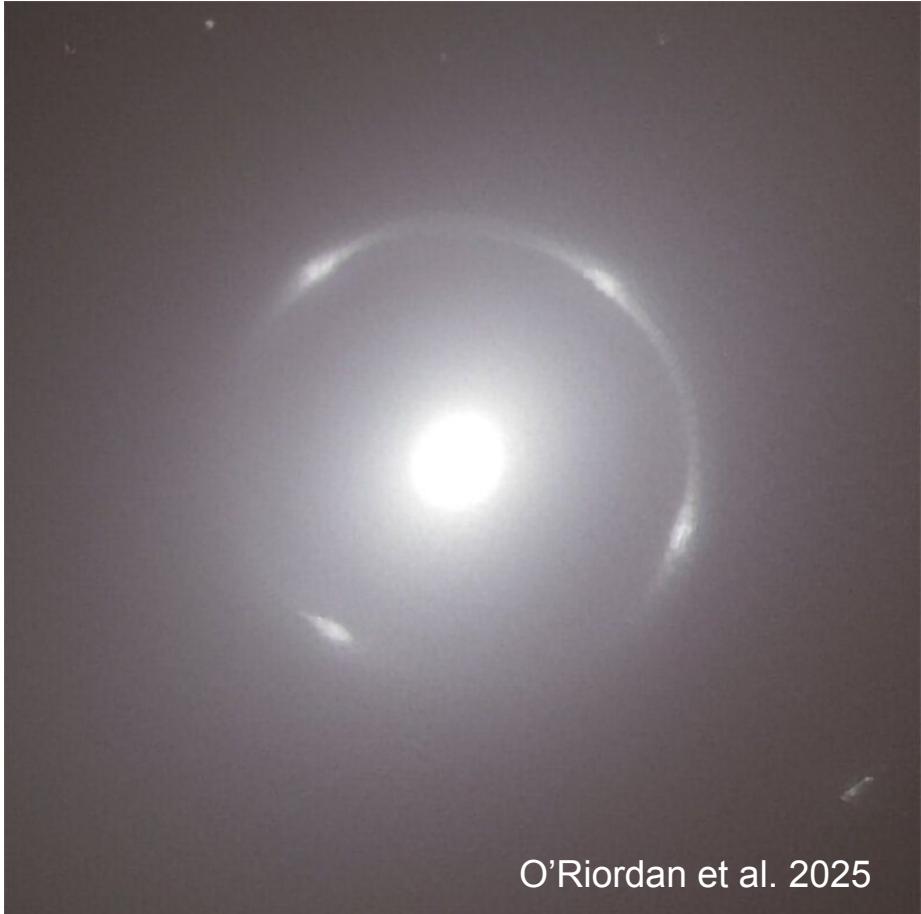
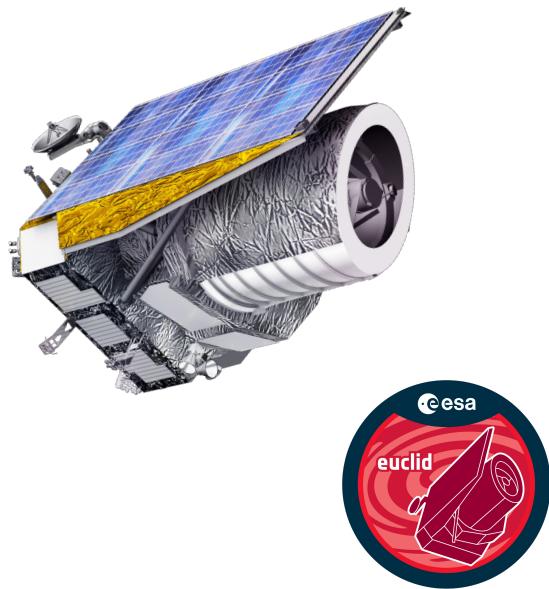
ESA Euclid
Space
Telescope



O'Riordan et al. 2025

Seeing the Universe through the Gravitational Lens

ESA Euclid
Space
Telescope



O'Riordan et al. 2025

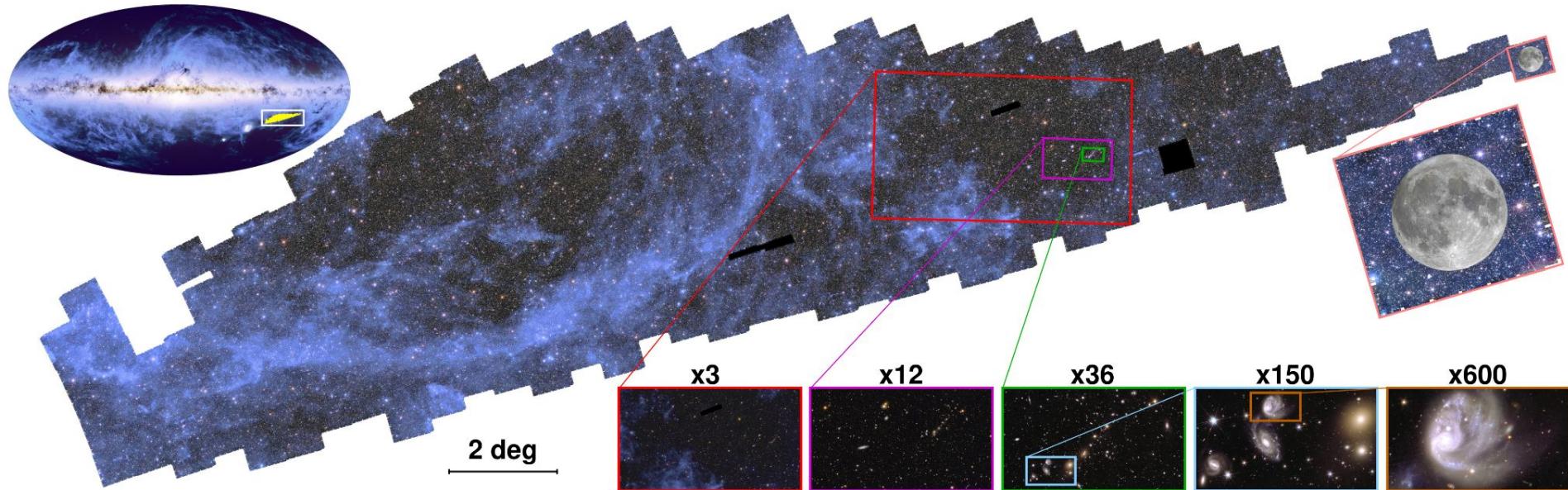
Seeing the Universe through the Gravitational Lens

Euclid will observe:

- The entire extragalactic sky
- 2 billion galaxies (1.9 billion more than previously known)
- 200,000 galaxy-scale strong lensing systems (currently only know ~1000)



Seeing the Universe through the Gravitational Lens

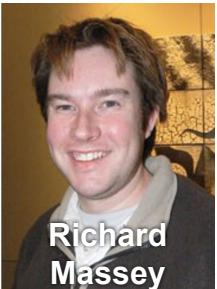




Meet your local lenses!



**Mathilde
Jauzac**



**Richard
Massey**



Alastair Edge



Russel Smith



**David
Lagattuta**



**Aris
Amvrosiadis**



**Max von
Wietersheim-
Kramsta**



Gavin Leroy



Leo Fung



Sam Lange



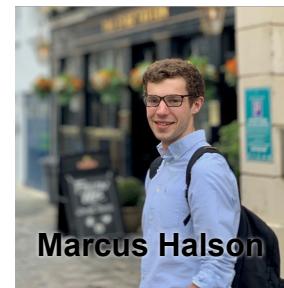
Nency Patel



Qiuhan He



**Catherine
Cerny**



Marcus Halson

NEWS

England | Local News | Wear

Scientists make 'insanely exciting' star discovery



NASA, ESA, AND J. LOTZ AND THE HFF TEAM

Scientists discovered 44 stars 6.5 billion light-years away in the Dragon Arc galaxy

Jonny Manning

BBC News, North East and Cumbria

9 January 2025 · [3 Comments](#)

Scientists have discovered 44 previously unknown stars which had been hidden behind a cluster of galaxies.

NEWS

'Ultramassive' black hole discovered by Durham astronomers

⌚ 29 March 2023



ESA/HUBBLE/DIGITIZED SKY SURVEY/NICK RISINGER

Scientists used gravitational lensing to find the "ultramassive" black hole (artist's impression)

Astronomers say they have found one of the universe's largest black holes to date using a new technique.