

Brown Dwarfs
Keep Their Cool:

30 Years of
Substellar
Science

1-5 September 2025, La Gomera, Canary Islands

Exploring ultra-cool dwarfs with Euclid

Anjana Mohandasan

UCD WP, MW_RSP SWG, EC



UNIVERSITÉ
MARIE & LOUIS
PASTEUR

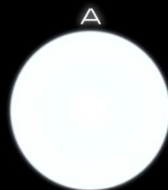
UTINAM
INSTITUT



Ultra-cool dwarfs

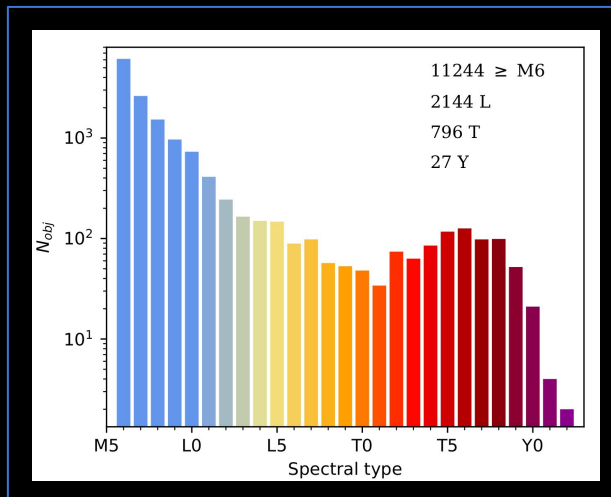


- Stars with spectral type M7 and later (Kirkpatrick et al. 1997)
- Denotes stellar to brown dwarf transition



Ultra-cool dwarfs

Known UCDs

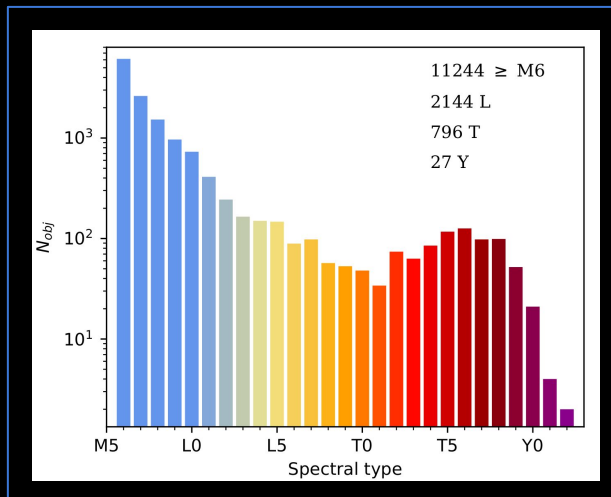


+

Ground-based
telescopes

Ultra-cool dwarfs

Known UCDs



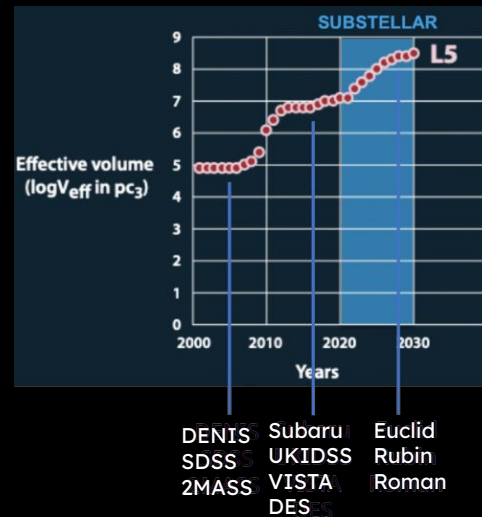
+

Ground-based
telescopes



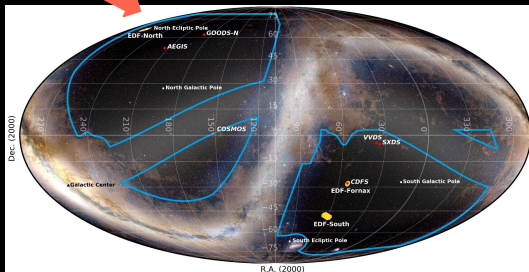
- Large sky survey
- Deep Infra-red colours
- Visible observations
- Superior sensitivity

Martin et al. 2023



Ultra-cool dwarfs: New Candidates

New - UCDs



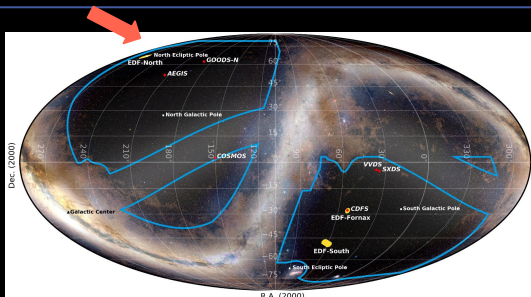
UCD template based search of
spectra
in **EDFN**

in Q1

202 new UCDs candidates

Ultra-cool dwarfs

New - UCDs

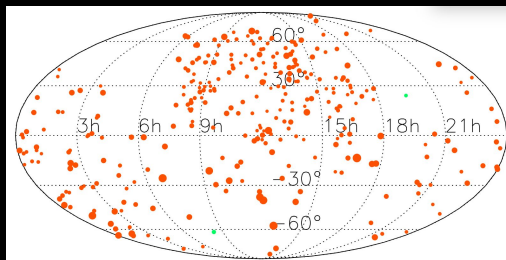


UCD template based search of
spectra
in **EDN**

in Q1

202 new UCDs candidates

Literature UCDs



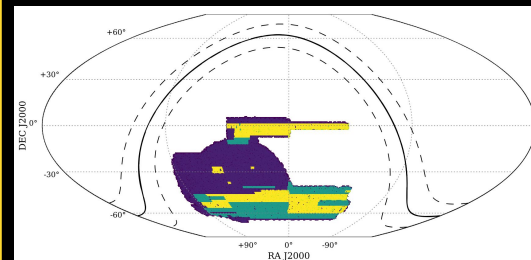
Smart et al. 2019 and more

8435 spectroscopic and
3821 photometric
M7-Y3 UCDs

in Q1

8 spectroscopic (2Ms +
2Ls + 4Ts) and
4 photometric (L + 3Ts)

DES UCDs



Carnero et al. (2019)

1745 LTs + 20863 Ms
VHS+DES+WISE
Photometric

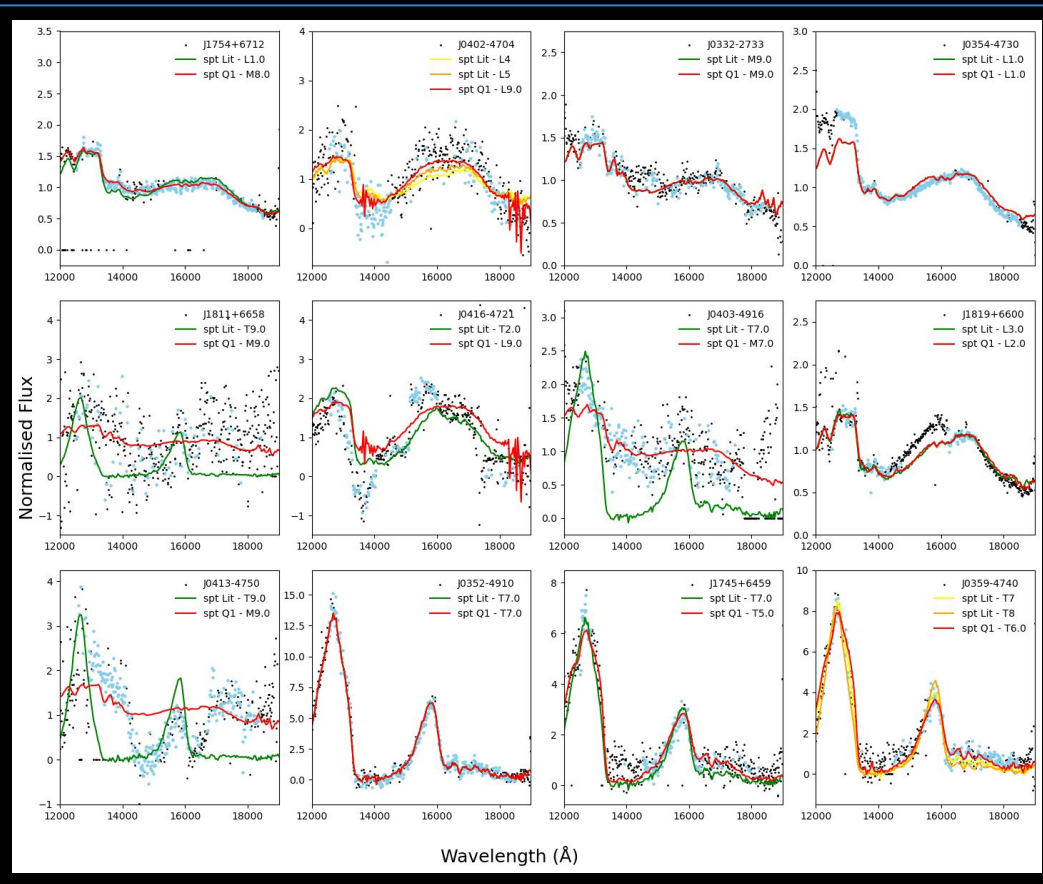
in Q1

220 Ms + 106 Ls

Spectroscopy

Q1 spectra of Literature UCDs

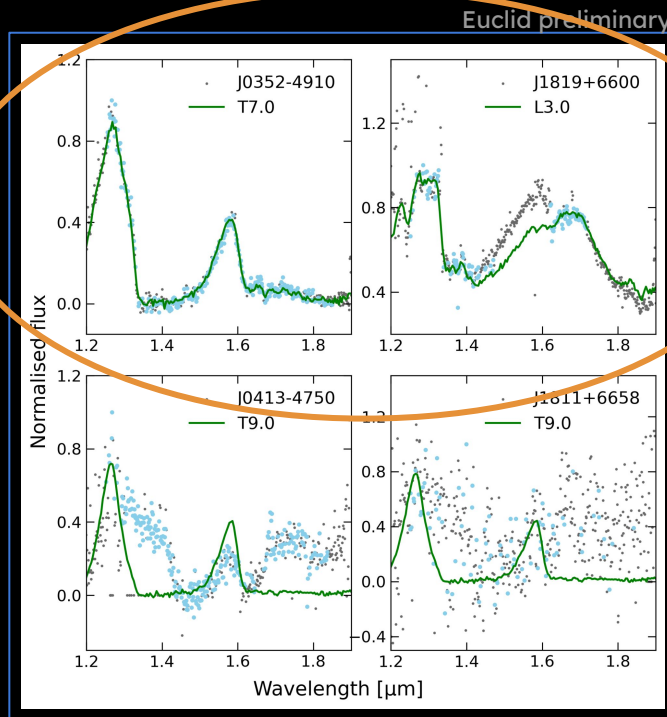
- Q1 spectral typing
- Lit spectral typing
- Selected points
(MASK= 0 & cutting spectrum edges)



Spectroscopy

Q1 spectra of Literature UCDS

- Lit spectral typing
- Selected points
(MASK=0 &
cutting spectrum edges)

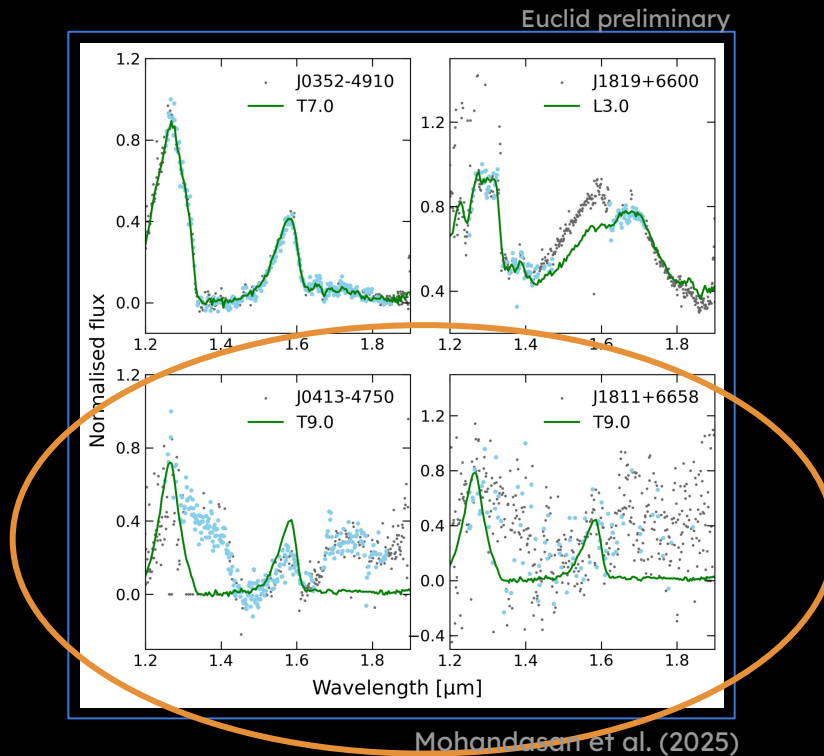


Mohandasan et al. (2025)

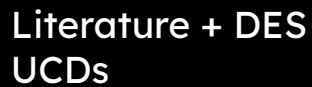
Spectroscopy

Q1 spectra of Literature UCDS

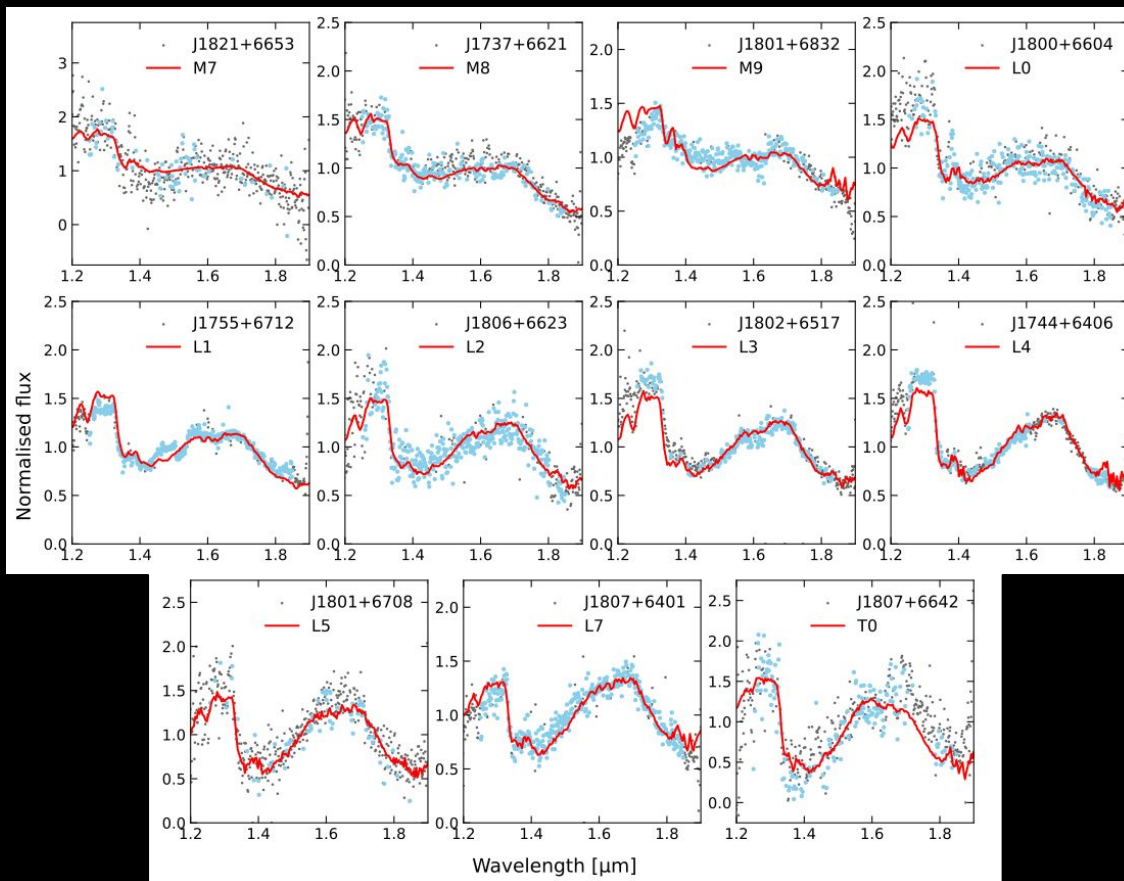
- Lit spectral typing
- Selected points
(MASK=0 &
cutting spectrum edges)



Ultra-cool dwarfs: Spectroscopy



A scatter plot comparing 'Known Spt' (x-axis) and 'Q1 spt' (y-axis) for two data series: 'Photometric' (blue circles) and 'Spectroscopic' (orange circles). The x-axis labels are M7, L0, L5, T0, T5, and Y0. The y-axis labels are M7, L0, L5, T0, T5, and Y0. A dashed green line represents the 1:1 relationship. The plot shows that photometric classifications are generally less accurate than spectroscopic ones, with many points falling below the 1:1 line, indicating they are classified as cooler than they actually are. Spectroscopic points are more tightly clustered around the 1:1 line.



New UCDs in EDFN

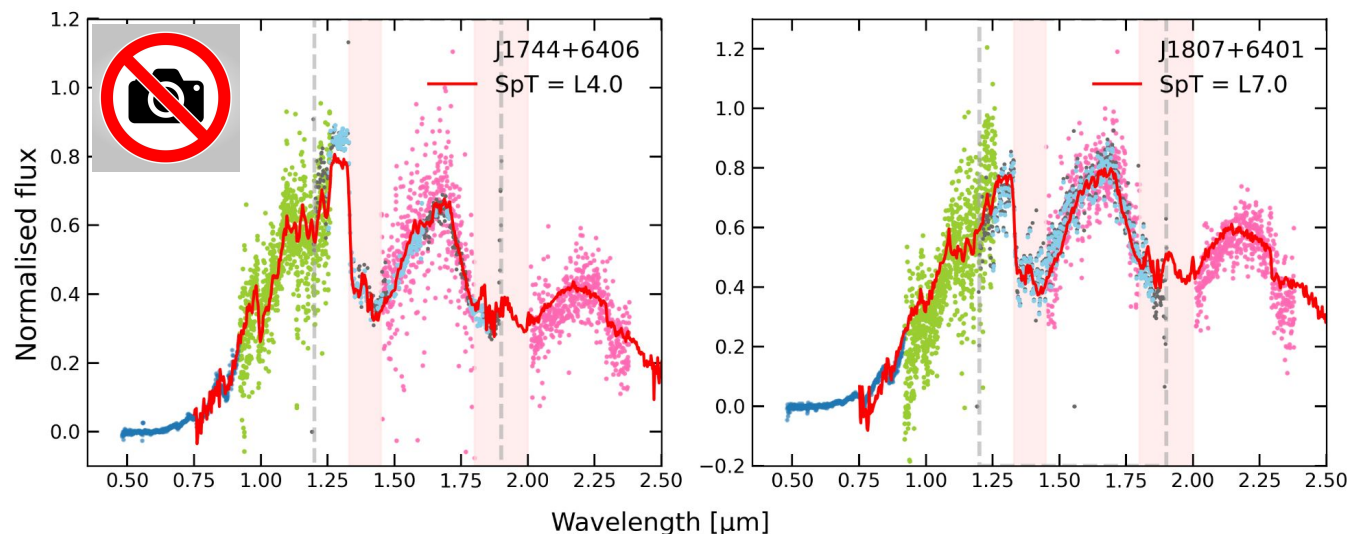
- 33 confirmed candidates

GTC follow up

EMIR, OSIRIS+

New UCDs

in EDFN



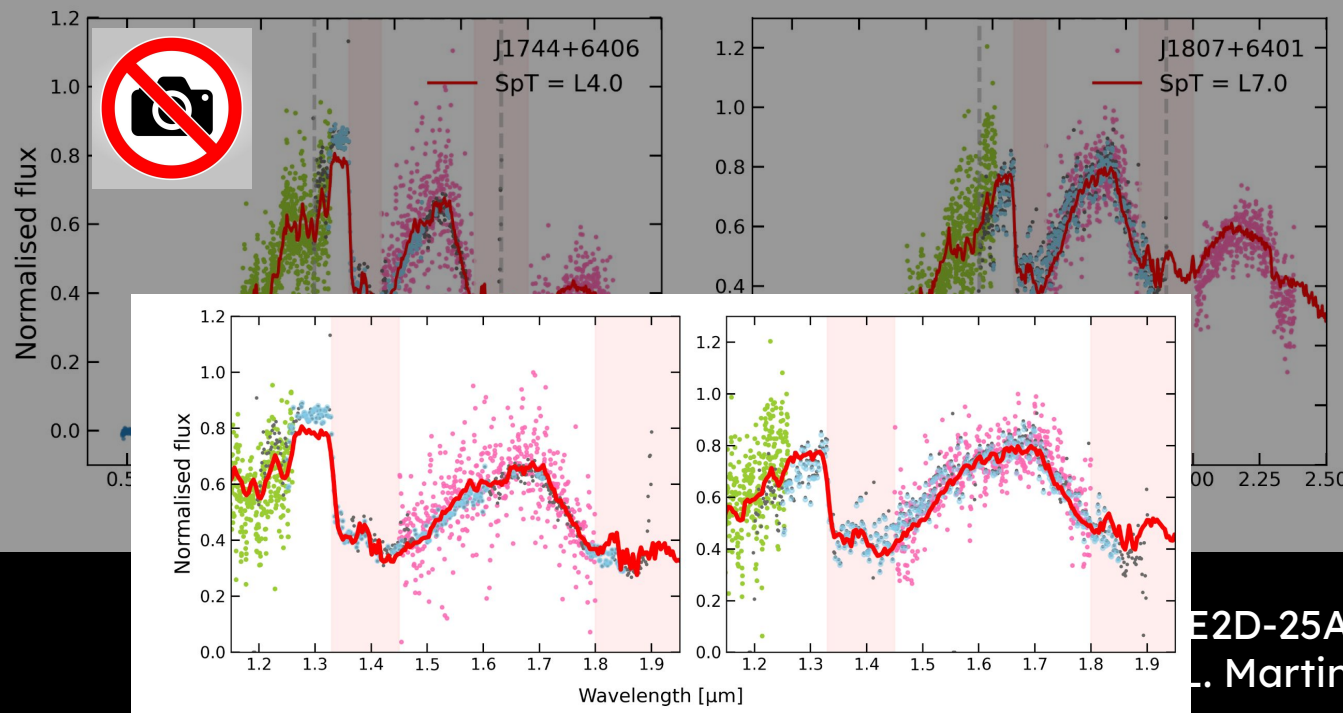
GTCMULTIPLE2D-25A
PI: Eduardo L. Martin

GTC follow up

EMIR, OSIRIS+

New UCDs

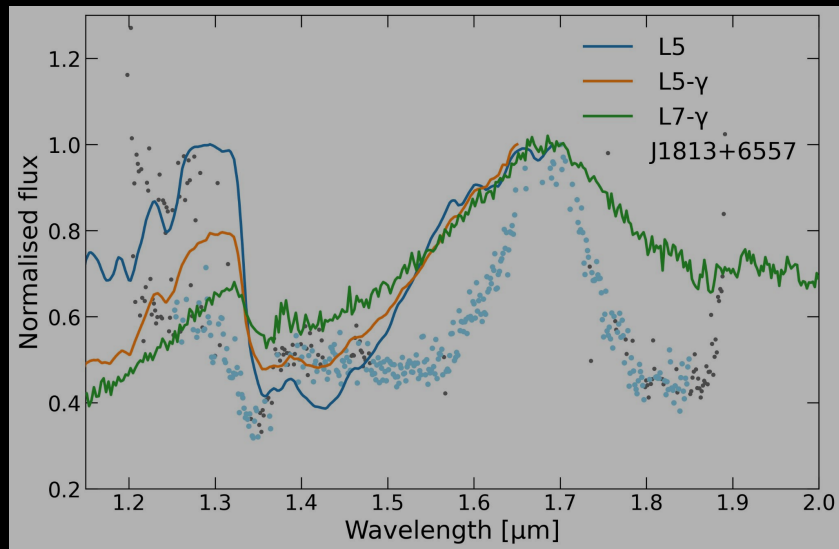
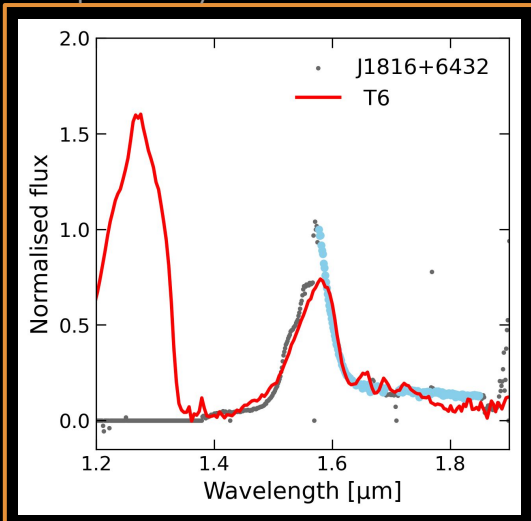
in EDFN



E2D-25A
L. Martin

Spectroscopy

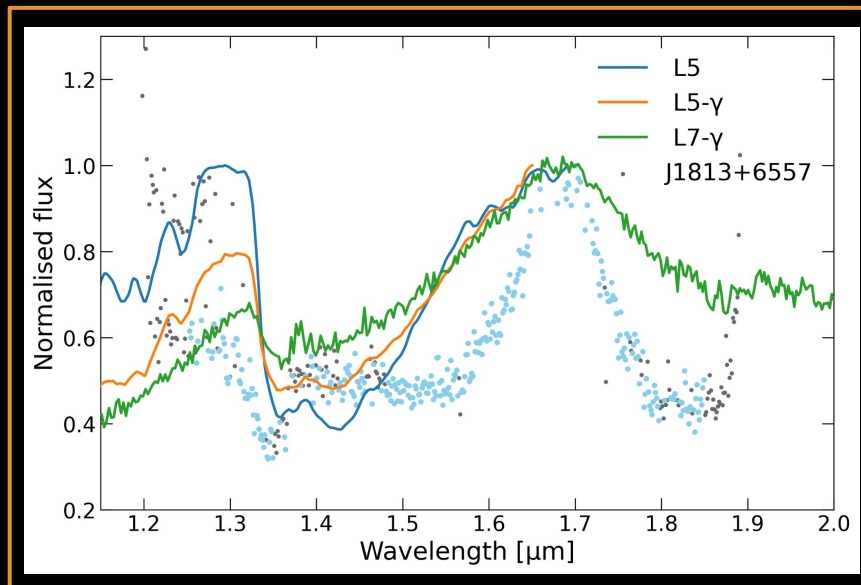
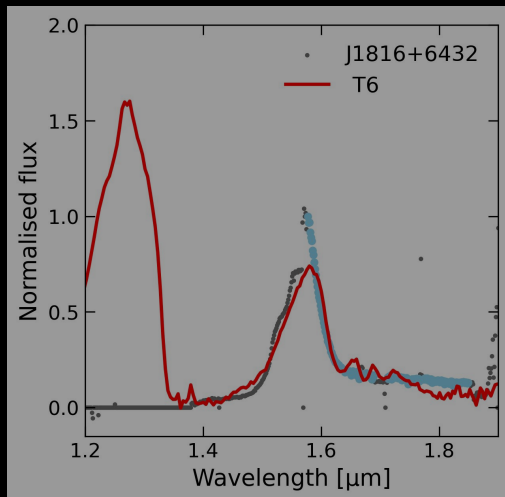
Euclid preliminary



Mohandasan et al. (2025)

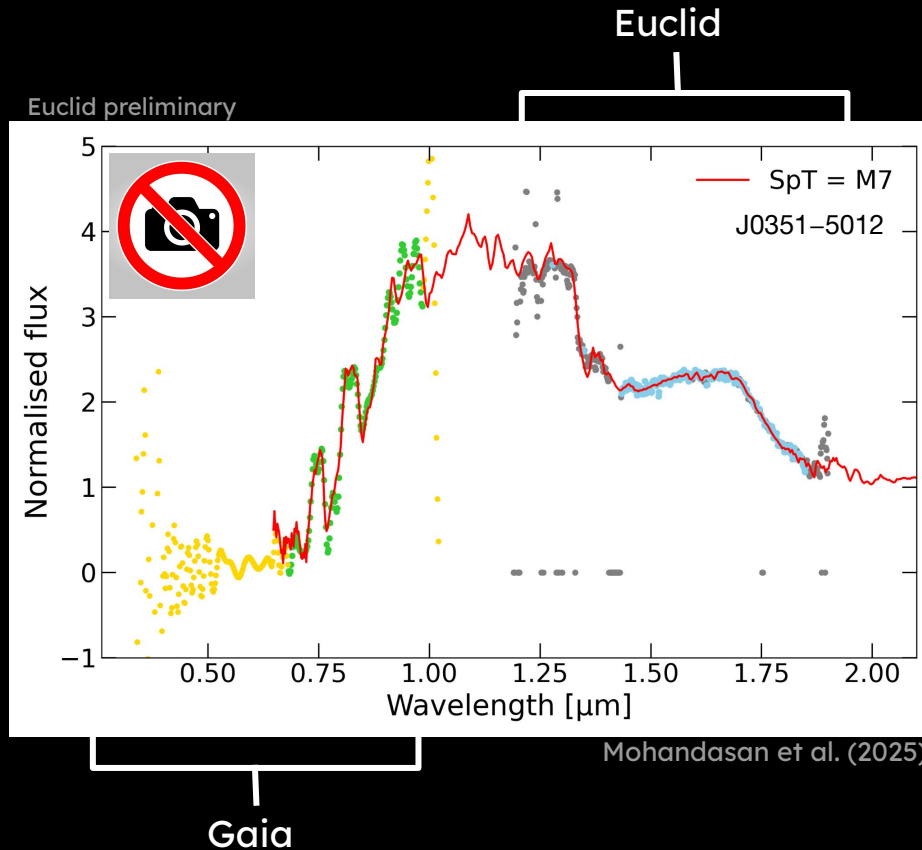
Spectroscopy

Euclid preliminary



Mohandasan et al. (2025)

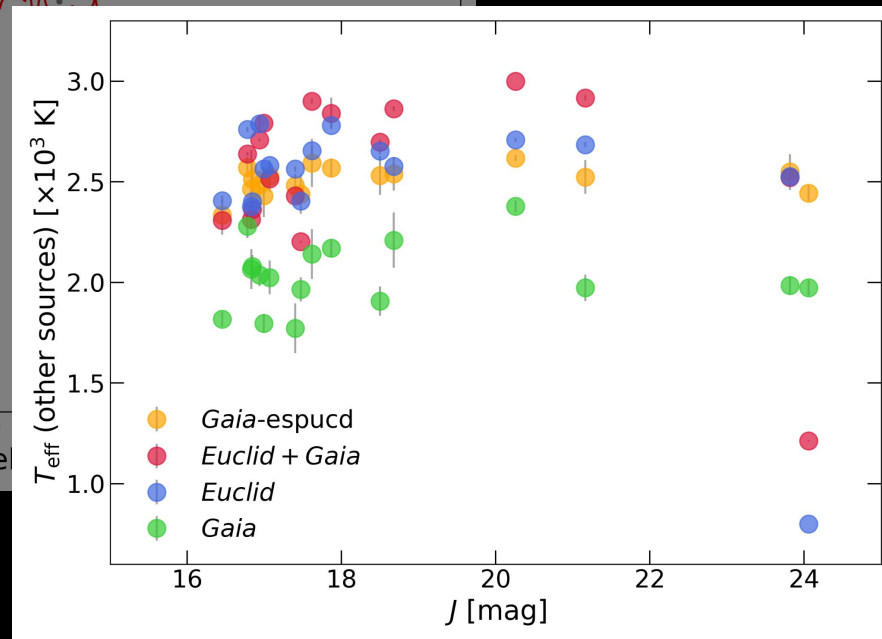
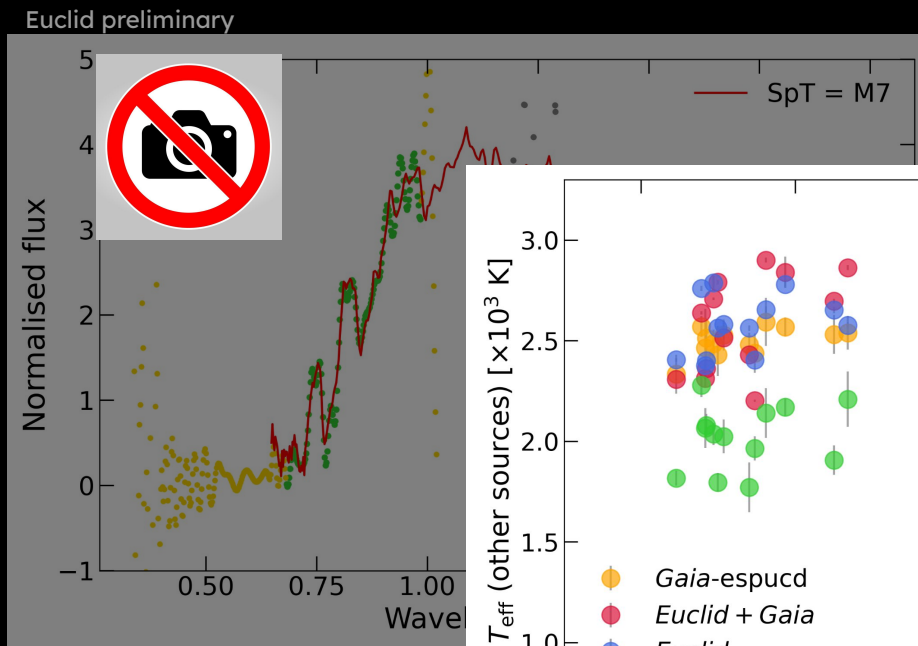
Gaia-Euclid Synergy



- Euclid
- selected

Gaia XP ●
~ Gaia RP ●

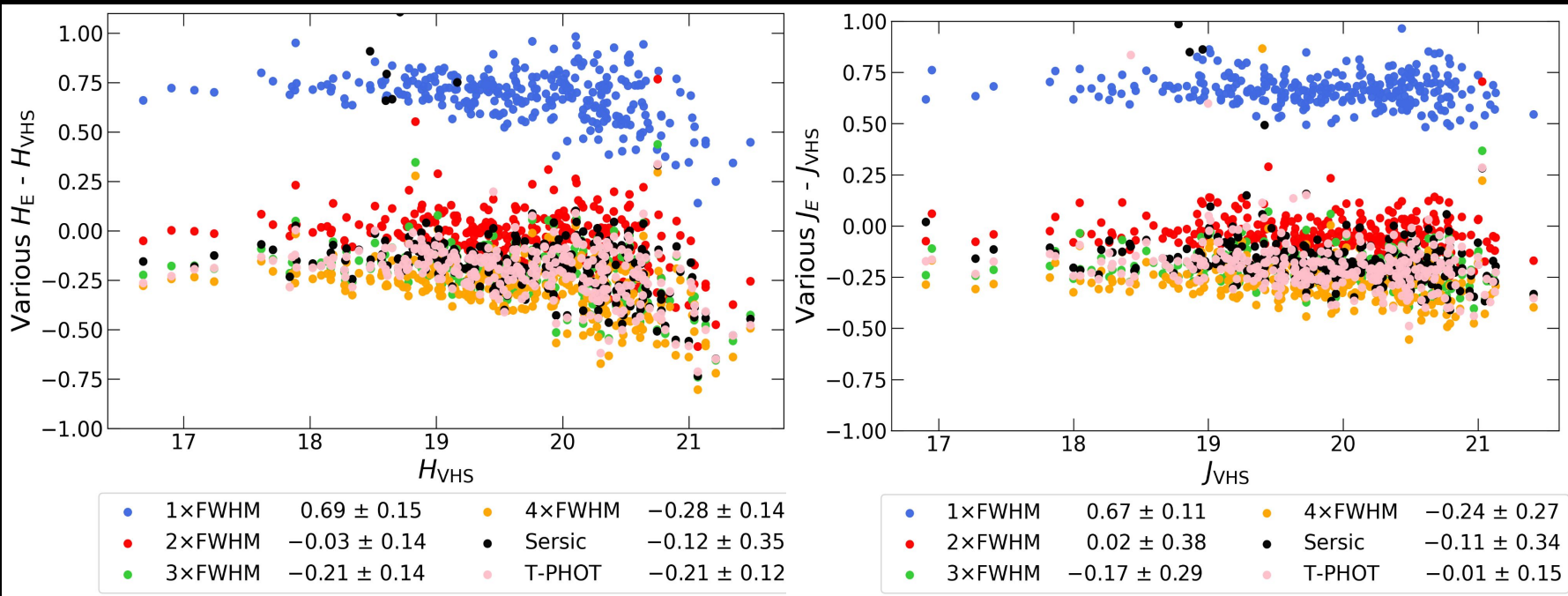
Gaia-Euclid Synergy



Photometry

Which Flux ?

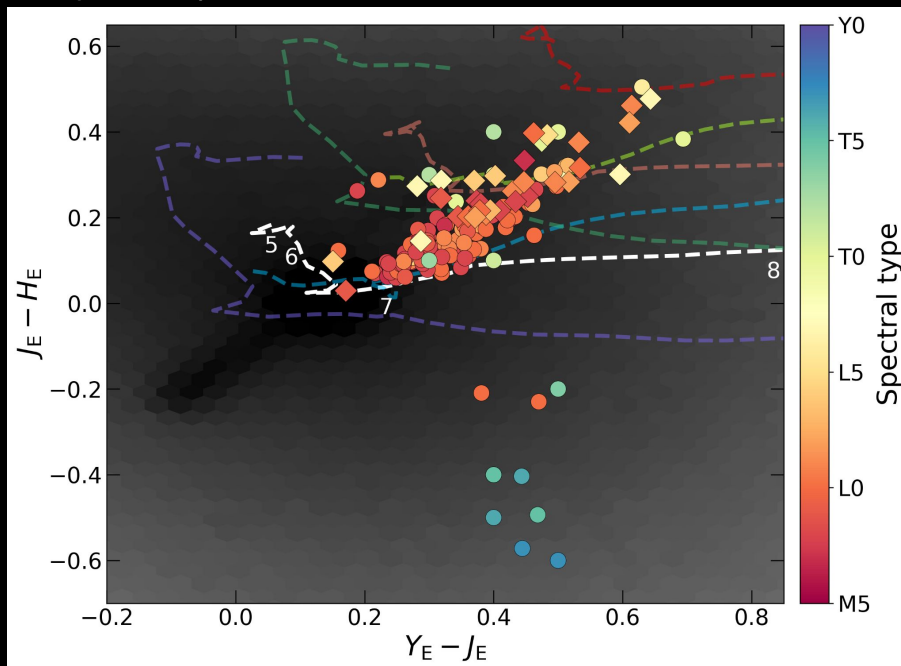
Euclid preliminary



Mohandas et al. (2025)

Photometry

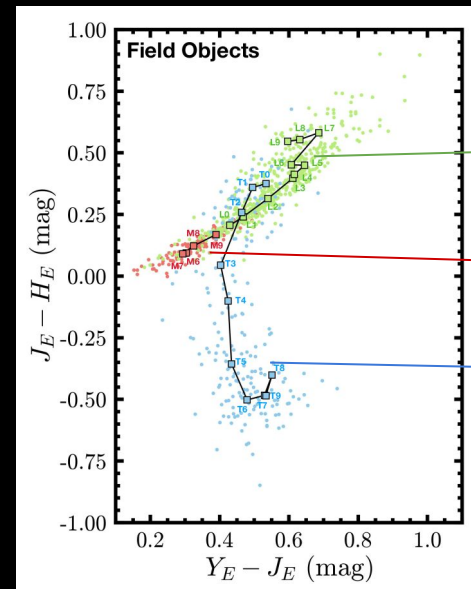
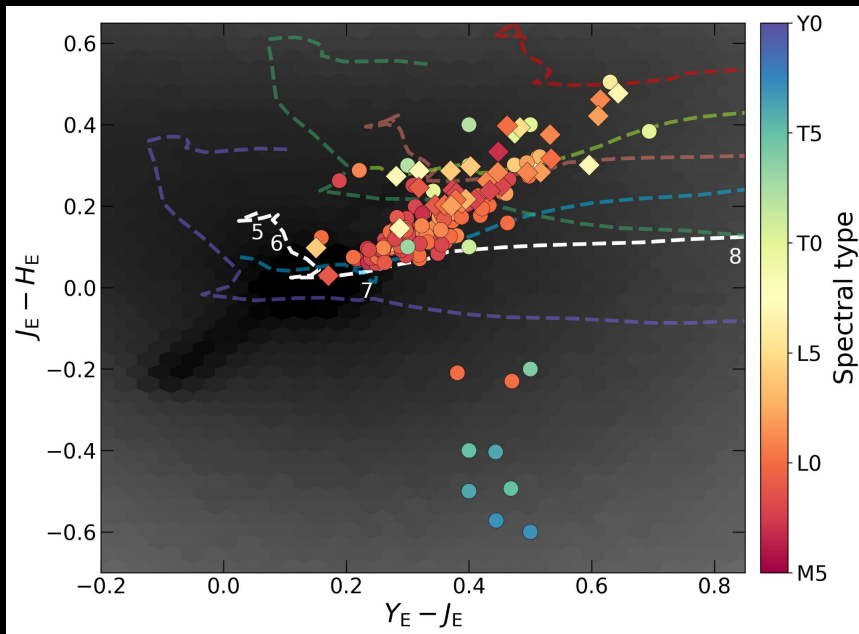
Euclid preliminary



- - - QSO track
- Q1 x DES UCDs
- ▲ Q1 x Lit UCDs
- ◇ New Q1 UCDs

Photometry

Euclid preliminary



L dwarf

M dwarf

T dwarf

Sanghi et al. 2024

Ultra-cool dwarfs with Euclid

Q1 exploration spectra based

- New-UCDs: 202
Good - 33
Interesting - 46
- Known UCDs
Good - 109 (mostly photometric)
Interesting - 20
- Gaia-Euclid objects
With photometry - 58
With spectra - 26

Astronomy & Astrophysics manuscript no. EC-UCD
March 31, 2025

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***Euclid* Quick Data Release (Q1) – Ultracool dwarfs in the Euclid Deep Field North ★**

A. Mohandasani^{★1}, R. L. Smart^{2,3}, C. Reylé¹, V. Le Brun⁴, A. Pérez-Garrido⁵, E. Bañados⁶, B. Goldman^{7,8},
H. R. A. Jones³, S. L. Casewell⁹, M. R. Zapatero Osorio¹⁰, T. Dupuy¹¹, M. Rejkuba¹², E. L. Martín^{13,14},
C. Dominguez-Tagle^{13,14}, M. Žerjal^{13,14}, N. Huélamo¹⁰, N. Lodieu^{15,14}, P. Cruz¹⁰, R. Rebolo^{13,16,14}, M. W. Phillips¹¹,
J.-Y. Zhang^{13,14}, N. Aghanim¹⁷, B. Altieri¹⁸, A. Amara¹⁹, S. Andreon²⁰, N. Auricchio²¹, C. Baccigalupi^{22,23,24,25},
M. Baldi^{26,21,27}, A. Balestra²⁸, S. Bardelli²¹, P. Battaglia²¹, A. Biviano^{23,22}, A. Bonchi²⁹, E. Branchini^{30,31,20},
M. Brescia^{32,33}, J. Brinchmann^{34,35}, S. Camera^{36,37,2}, G. Cañas-Herrera^{38,39,40}, V. Capobianco², C. Carbone⁴¹,
J. Carretero^{42,43}, S. Casas⁴⁴, M. Castellano⁴⁵, G. Castignani²¹, S. Cavuoti^{33,46}, K. C. Chambers⁴⁷, A. Cimatti⁴⁸,
C. Colodro-Conde¹³, G. Congedo¹¹, C. J. Conselice⁴⁹, L. Conversi^{50,18}, Y. Copin⁵¹, A. Costille⁴, F. Courbin^{52,53},
H. M. Courtois³⁴, M. Cropper⁵⁵, A. Da Silva^{56,57}, H. Degaudenzi⁵⁸, G. De Lucia²³, H. Dole¹⁷, M. Douspis¹⁷,
F. Dubath⁵⁸, X. Dupac¹⁸, S. Dusini⁵⁹, S. Escoffier⁶⁰, M. Farina⁶¹, F. Faustini^{45,29}, S. Ferriol⁵¹, S. Fotopoulou⁶²,

2025

Available in archive

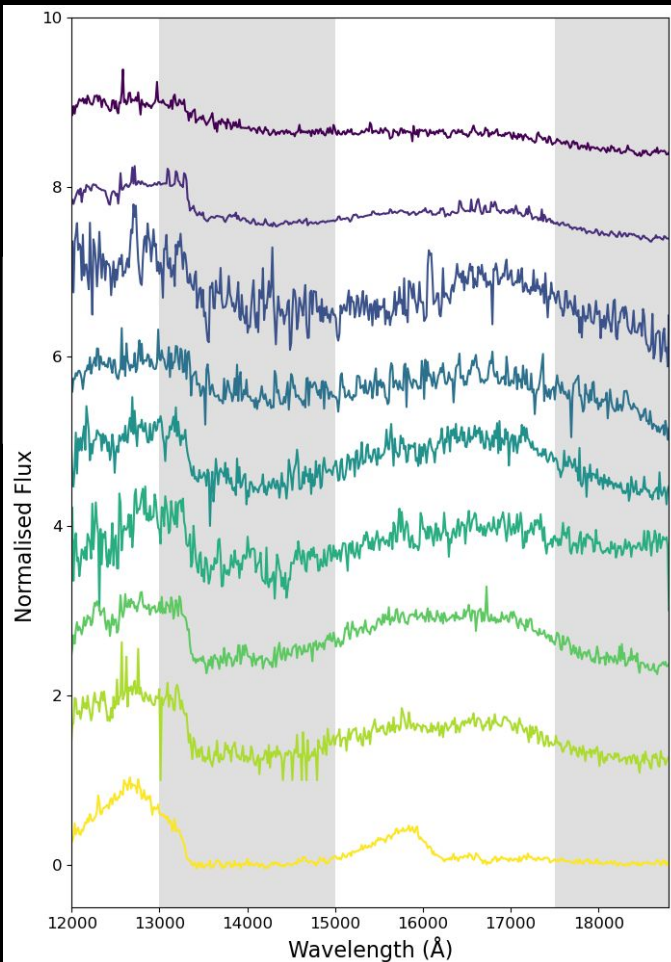
Ultra-cool dwarfs with Euclid

First step

- UCDs in Euclid: Known and New.
- Euclid spectra and spectral typing: For new and known.
- Overlap between QSO and UCDs in colour space.
- Q1 paper and catalogue
- Gaia-Euclid spectra combination and model fitting

In near future

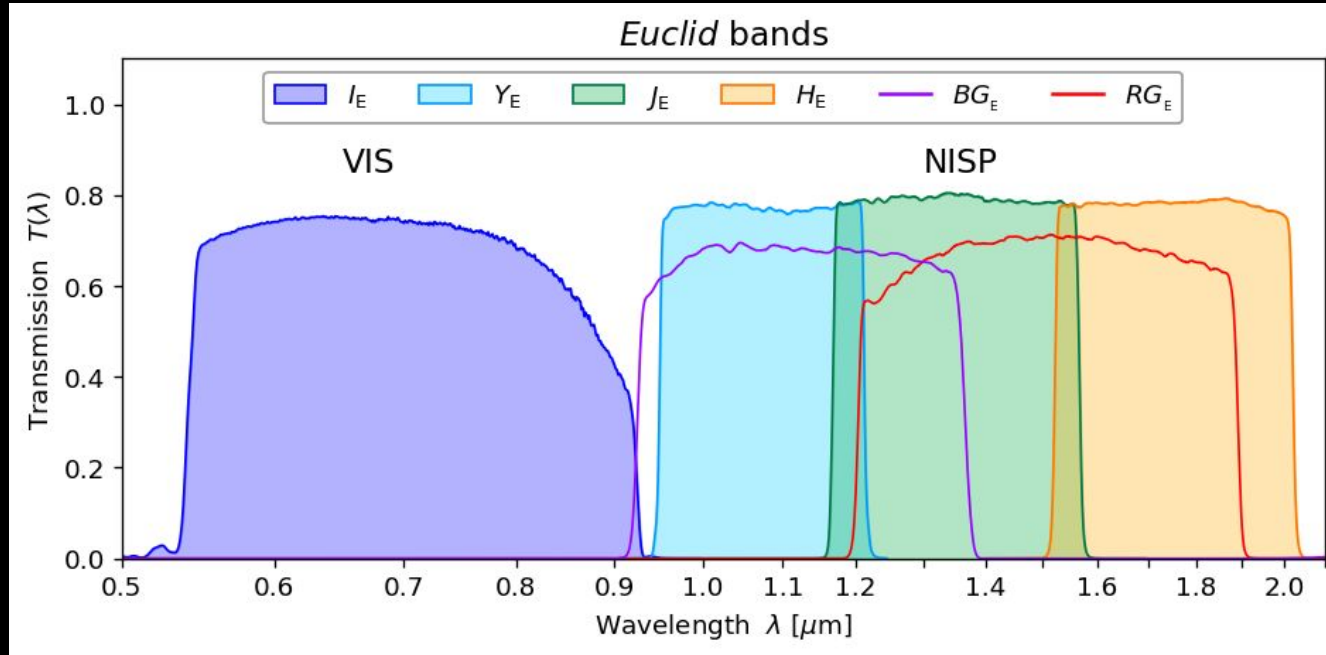
- Selection criterions to detect more with Euclid
- Explore different populations in the Milky Way, in the thick disc and also Halo.
- Luminosity and Mass functions: low-mass end
- Substellar formation history





Thank you

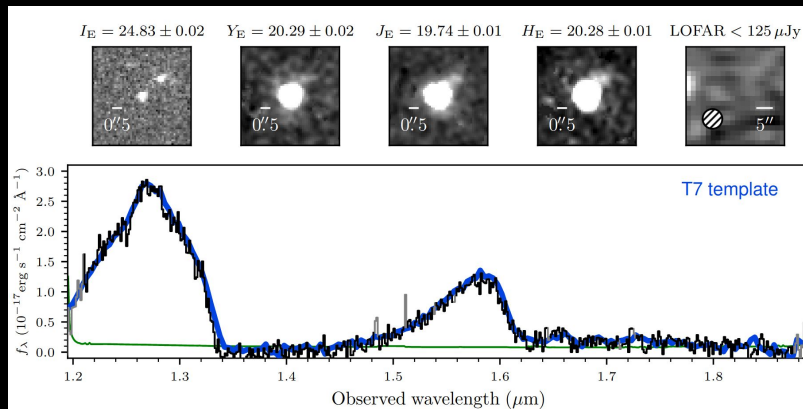




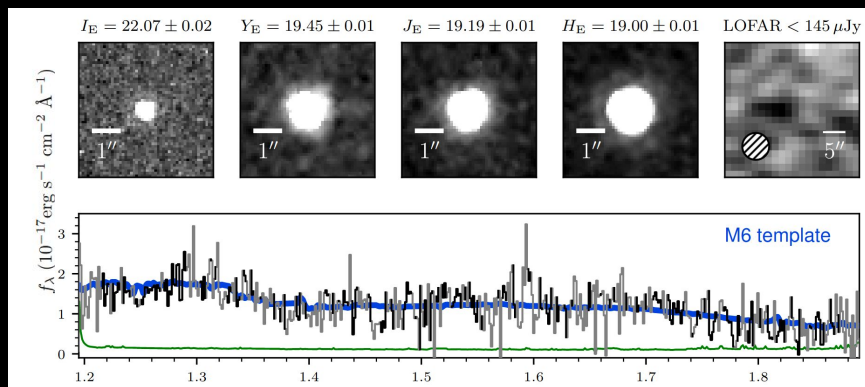
Spectroscopy

From Euclid - QSO
search

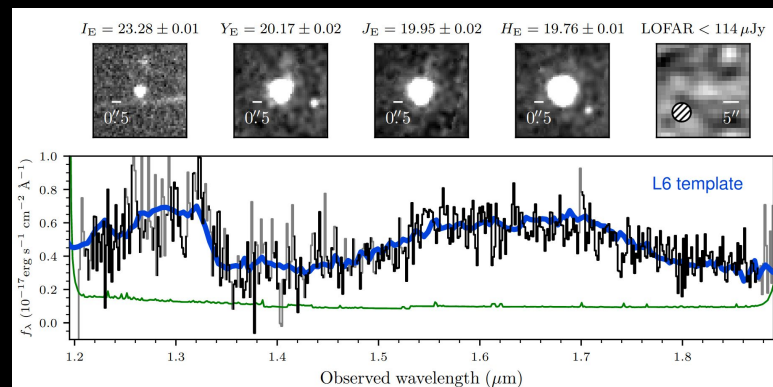
Bañados et al. (in prep)



WISE J174556.65+645933.8 (EUCL J266.48504+64.99357)

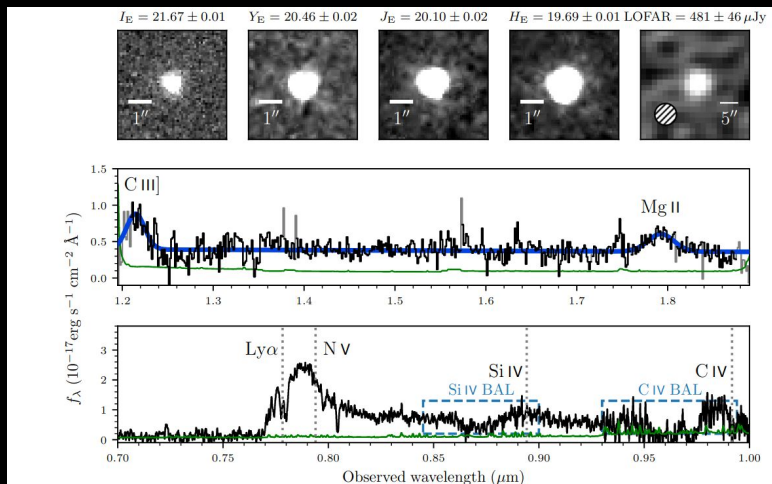


EUCL J266.12418+67.45781

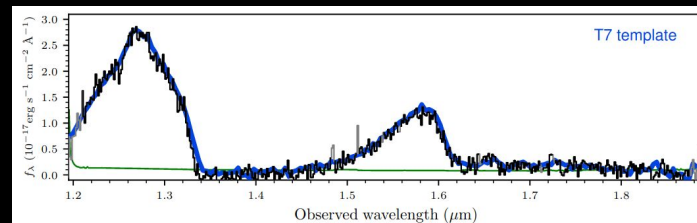


EUCL J273.00762+66.26935

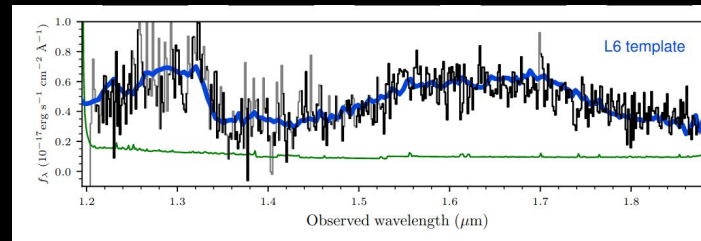
Spectroscopy



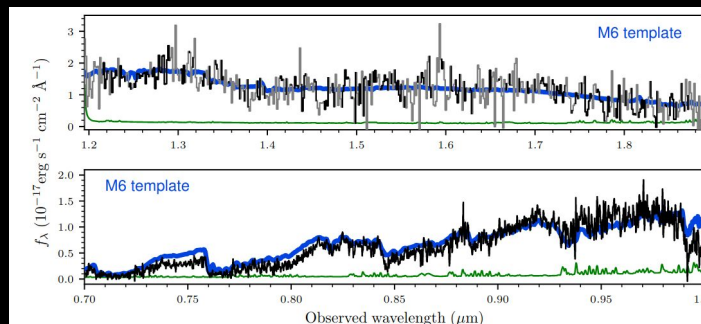
$z = 5.4$ quasar
 EUCL J273.87506+65.34833



WISE J174556.65+645933.8 (EUCL J266.48504+64.99357)

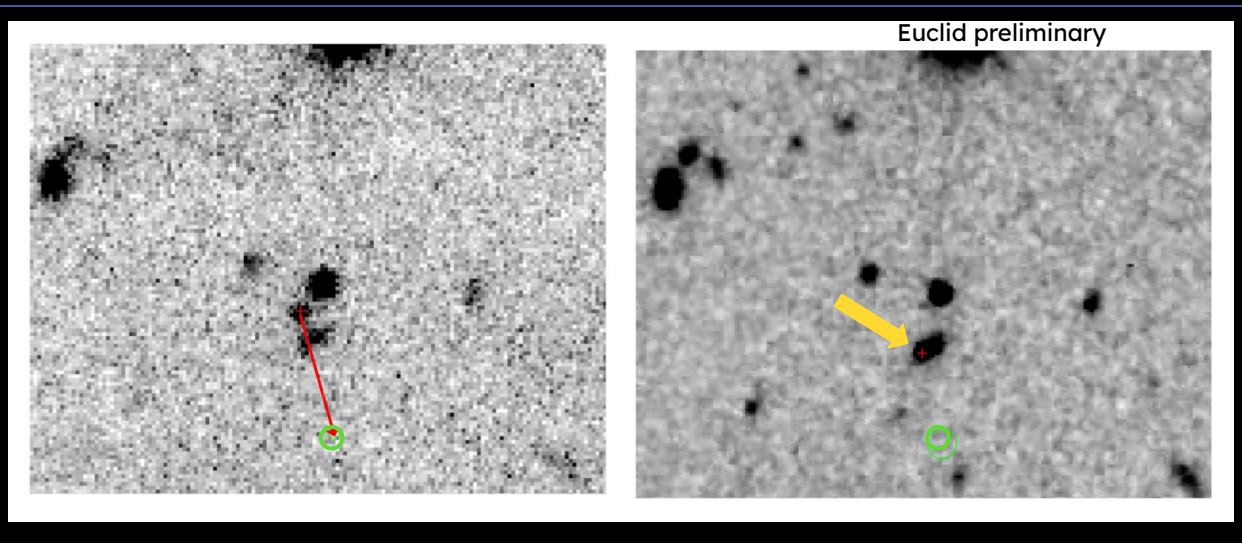


EUCL J273.00762+66.26935



EUCL J266.12418+67.45781

J1811+6658 - CWISE J181125.34+665806.4



Keck MOSFIRE
J(MKO) band
27 August 2021

Euclid J image
18 July 2024

J1811+6658 - CWISE J181125.34+665806.4

