Title: Preparation of Euclid Legacy Science on Ultracool Dwarfs

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Context of the Research

- Starting point: 16 February 2012

ESA Announcement of Opportunity for an Independent Legacy Scientist (ILS) Cool Dwarfs

ILS proposal entitled:
The Euclid View on Activity, Binarity, Habitability and Weather in Ultra-Cool Dwarfs
selected by ESA

ILS proposer: Eduardo L. Martín
Initial collaborators: David Barrado y Navascués, Hervé Bouy, Nuria Huélamo, Nicolas Lodieu, Basmah Riaz, Johannes Sahlmann & Enrique Solano
Additional collaborators: Adam Burgasser, Carlos del Burgo, Víctor Sánchez Béjar, María Morales, Antonio Pérez Garrido

Science cases of ILS proposal:
1) Discovery of new UCDs
2) Discovery of new sub UCDs
3) Binaries among UCDs
4) Planets around UCDs
5) Variability among UCDs
6) The bottom of the IMF

ILS activities:
Coordination between ILS team & Euclid consortium (archive, pipelines, survey and Milky Way working groups)
Participation in Euclid Science Team Meetings & Activities
Development of simulation tools
Construction of reference catalogs
Preparatory papers
Definition of archive & pipeline requirements

euclid

Launch in 2022

Description of the work: Search for ultracool dwarfs in Deep surveys

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Ultracool Dwarfs in deep extragalactic surveys using the Virtual Observatory: ALHAMBRA and COSMOS

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ABSTRACT

Ultracool dwarfs **encompass a wide variety of compact stellar-like objects with spectra classified as late-M, L, T and Y**. Most of them have been discovered using wide-field imaging surveys. The Virtual Observatory has proven to be of great utility to efficiently exploit these astronomical resources. We aim to validate a Virtual Observatory methodology designed to discover and characterize ultracool dwarfs in deep extragalactic surveys like ALHAMBRA and COSMOS. Three complementary searches based on parallaxes, proper motions and colours, respectively were carried out. A total of 897 candidate ultracool dwarfs were found, with only 16 previously reported in SIMBAD. **Most of the new UCDs reported here are likely late-M and L dwarfs because of the limitations imposed by the utilization of *Gaia* DR2 data.** We complement ALHAMBRA and COSMOS photometry with other catalogues in the optical and infrared using VOSA, a Virtual Observatory tool that estimates effective temperatures from the spectral energy distribution fitting to collections of theoretical models. The agreement between the number of UCDs found in the COSMOS field and theoretical estimations together with the low false negative rate (known UCDs not discovered **in our search) validates the methodology proposed in this work, which will be used in the forthcoming wide and deep surveys provided by the Euclid space mission. Simulations of Euclid number counts for UCDs detectable in different photometric passbands are presented, and the limitations of applicability of Euclid data to detect UCDs using the methods employed in this paper are discussed.**

Results: 881 new ultracool dwarfs in ALHAMBRA & COSMOS

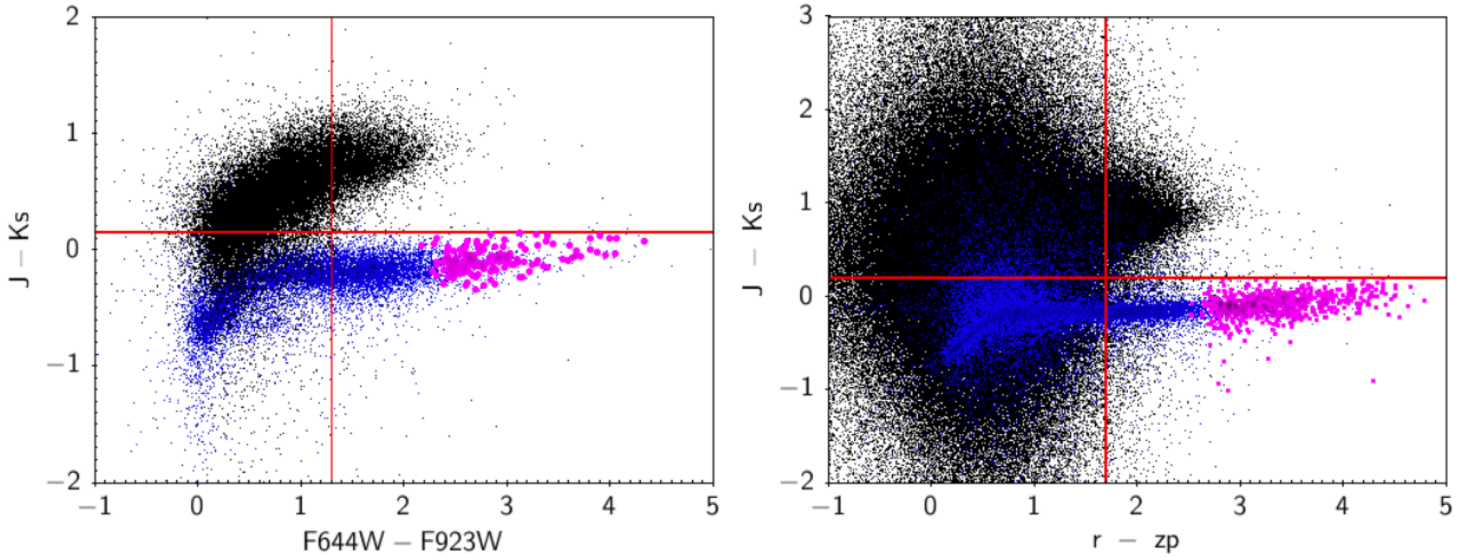

Figure 4. ALHAMBRA (left) and COSMOS (right) colour-colour diagrams. Black and blue dots represent galaxies and stars, respectively. The vertical and horizontal red lines mark the boundaries of the stellar and galactic locus. Pink bullets represent the 164 (30+1+133) ALHAMBRA and the 733 (1+1+731) COSMOS candidate UCDs.

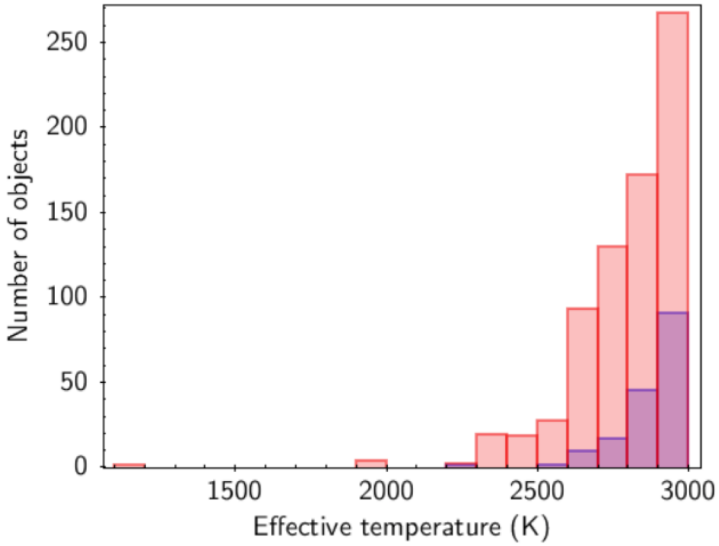

Figure 5. $T_{\rm eff}$ distribution of the candidate UCDs identified in COSMOS (red) and ALHAMBRA (blue).

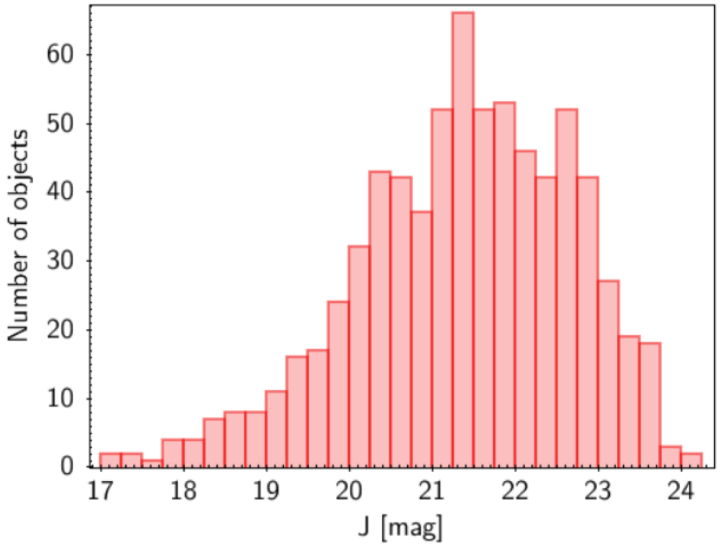

Figure 6. Distribution of the COSMOS candidate UCDs magnitudes. UltraVISTA DR2 J-band (AB) magnitude in a 3" aperture have been considered.

Results: Simulations of UCD numbers detectable with Euclid

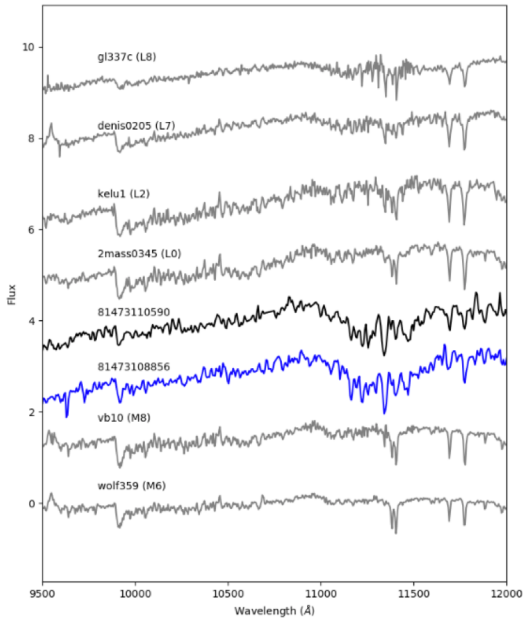

Figure 8. Comparison of the LIRIS spectra of two of our ALHAMBRA UCD candidates with template spectra from the NIRSPEC library.

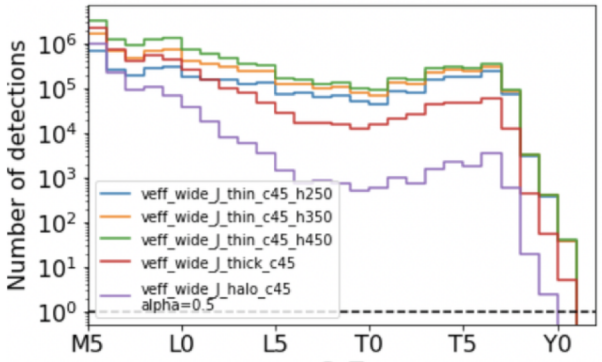

Figure 9. Simulated number counts of UCDs detected by the Euclid wide survey in the J-band.

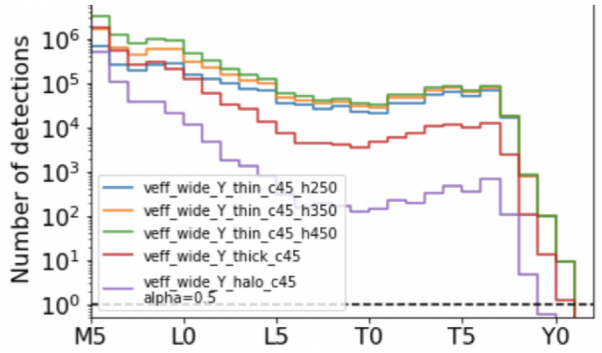

Figure 10. Simulated number counts of UCDs detected by the Euclid wide survey in the Y-band.

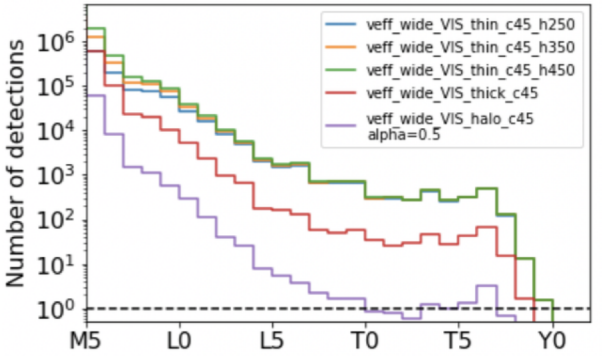

Figure 11. Simulated number counts of UCDs detected by the Euclid wide survey in the VIS-band.

and STILTS (Taylor 2006) as well as the Vizier and SIMBAD services, both operated at CDS, Strasbourg, France.

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Impact and prospects for the future

Euclid surveys will provide a unique source of UCD discoveries: 2 mag deeper (NISP) than VHS/UKIDSS and 3-4 mag deeper (VIS) than Gaia to search for UCDs. Big data, big science, and plenty of things to do!

Euclid will benefit from having well-studied benchmark UCDs, ahead of the launch, particularly those located in the calibration & the deep fields.

Euclid specific science cases for UCD science are being updated with the latest results & simulations.

First Euclid ILS preparatory science paper on UCDs under review for MNRAS