
# **Olga** Balsalobre-Ruza

PhD candidate [defending in May 2026]

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Spanish [Native] & English [Advanced, C1]


I graduated in Physical Sciences with a major in Astrophysics from the *Complutense University of Madrid*. I pursued various internships to explore the areas that interested me the most, including high-energy astrophysics, observational astronomy, instrumentation with data from the Rover Curiosity, and exoplanet research. Currently, I am a **last-year** (fourth) **PhD student** at the *Center for Astrobiology* in Madrid, specializing in the **search** and characterization of **exoplanets** and co-orbitals using various techniques, with a strong focus on the **radial velocity** (RV) and **direct imaging** (DI) methods. I am an enthusiastic Python programmer with a keen interest in expanding my skills, for instance in astro-statistics and machine learning. During my PhD, I published **4 first-author** and **7 co-authored papers**, developed **2 Python packages**, and presented my work at international conferences and institutions (**16 talks** & **6 posters**). I enjoy both independent and collaborative work, seeing the latter as necessary in science.

## Education

**Bachelor in Physics**
University Complutense of Madrid (UCM)
- Honors in three subjects
- Speciality in Astrophysics

2015 - 2020

**BSc thesis**
Gamma Rays data analysis detected with Cherenkov telescopes

**Master in Astrophysics**
UCM
- Honors in two subjects
- Honors in the MSc thesis

2020 - 2021

**MSc thesis**
Development of a Python algorithm to improve the efficiency of the detection of exoplanets in Radial Velocity (RV) Surveys

**PhD in Astrophysics**
UCM & Center for Astrobiology (CAB)
supervised by **Dr. Jorge Lillo-Box** & **Dr. Nuria Huélamo**

Multi-technique search for co-orbital exoplanets with RV, DI and transits.

2022 - [2026]

## Publications in peer-reviewed journals [see list in ADS]

### First-authored

(1) **Balsalobre-Ruza** et al., in prep.
*Inner dust clumps in PDS 70 revealed by SPHERE with star-hopping*

(2) **Balsalobre-Ruza** et al., A&A, 694, A15
*KOBE-1: The first planetary system from the KOBE survey. Two planets likely in the sub-Neptune mass regime around a late K-dwarf*

(3) **Balsalobre-Ruza** et al., 2024, A&A, 689, A53
*The $\mathcal{TROY}$ project: III. Exploring co-orbitals around low-mass stars*

(4) **Balsalobre-Ruza** et al., 2023, A&A, 675, A172 [ESO press release]
*Tentative co-orbital submillimeter emission within the Lagrangian region L5 of the protoplanet PDS 70 b*

(5) **Balsalobre-Ruza** et al., 2022, A&A, 669, A18
*KOBEsim: A Bayesian observing strategy algorithm for planet detection in radial velocity blind-search surveys*

### Co-authored

(1) **Figueira** et al., 2025, accepted in A&A, arXiv:2507.07514 [Author 9, scientific feedback on photometric centroid analysis]
*A comprehensive study on radial velocity signals using ESPRESSO: Pushing precision to the 10 cm/s level*

(2) **Grouffal** et al., 2025, submitted in A&A, arXiv:2507.01807 [Author 9, analysis and text on CARMENES RV, Sect. 2]
*The star HIP 41378 potentially misaligned with its cohort of long-period planets*

(3) **Cesario** et al., 2024, A&A, 692, A172 [Author 27, manuscript revision]
*Large Interferometer For Exoplanets (LIFE). XIV. Finding terrestrial protoplanets in the galactic neighborhood*

(4) **Lillo-Box** et al., 2024, A&A, 689, L8 [Author 8, manuscript revision]
*K2-399 b is not a planet: The Saturn that wandered through the Neptune desert is actually a hierarchical eclipsing binary*

(5) **Lillo-Box** et al., 2024, A&A, 686, A232 [Author 4, scientific feedback on the centroid analysis Sect. 3.4]
*The AstraLux-TESS high spatial resolution imaging survey. Search for stellar companions of 215 planet candidates from TESS*

(6) **Christiansen** et al., 2023, ASCL [Author 5, minor coding contribution]
*VCAL-SPHERE: Hybrid pipeline for reduction of VLT/SPHERE data*

(7) **Lillo-Box** et al., 2022, A&A, 667, A102 [Author 8, sample selection and text Sect. 4.3]
*The KOBE experiment: K-dwarfs Orbited By habitable Exoplanets. Project goals, target selection, and stellar characterization*

### Book Chapter

- **Lillo-Box** & **Balsalobre-Ruza** (to be published), Elsevier
  *Exoplanet Detection Methods. Chapter 8. Orbital Phase Modulations*

## Research experience

- Jun 2024 - Aug 2025 [2 months] **Predoctoral stay.** *Training in N-body simulations and collaboration with Dr. Nathaly Bathala's group. UCSC (California, USA)*
- Oct 2022 - Nov 2022 [1 month] **Predoctoral stay.** *Training in the analysis of ALMA observations with Dr. Itziar de Gregorio*. ESO (Santiago de Chile, Chile)
- **Mar 2022 - Currently** [3 years] **Predoctoral Researcher.** *Search for co-orbital exoplanets in the **TROY project***. CAB (Madrid, Spain)
- Dec 2021 - Mar 2022 [4 months] **Research Assistant.** *Exoplanets. On the rocks project.* Autónoma University of Madrid (UAM) (Madrid, Spain)
- Jul 2021 - Sep 2021 [3 months] **Summer Internship.** *Characterization of the atmospheric extinction of the Javalambre Observatory.* CEFCA (Teruel, Spain)
- Feb 2021 - Jun 2021 [5 months] **Internship Trainee.** *Support to the Mars data analysis with the Rover Curiosity.* CAB (Madrid, Spain)
- Feb 2019 - Feb 2020 [1 year] **Internship Trainee.** *Characterization of the LST-1 Cherenkov telescope camera.* CIEMAT (Madrid, Spain)

## Coding

- **Python:** 6-year experience as daily user. 54-hour online courses. Codes available in GitHub:
  - **MOCA** - RV simulator of planetary signals. Focused on preparing observing proposals and injection recovery for sensitivity analysis [to be published]
  - **VCAL-SPHERE** - Collaborator in a SPHERE pipeline published in ASCL
  - **KOBEsim** - Bayesian algorithm to plan RV observations to boost the detection of exoplanets
- **Machine Learning & AI:** 240-hour course by *Samsung Innovation* in the Polytechnic University of Madrid (UPM). 18-hour course by IPARCOS applied to physics and astrophysics (UCM). Application of Random Forest algorithms in my BSc thesis with Python
- **Other:** experience with Matlab, R, Stan, IDL, SQL, Git, HTML. User of macOS, Linux and Windows

## Observational experience

- Jun 2024. **6 nights with HARPS-N** in the TNG (La Palma Observatory) [Visitor Mode]
- Feb 2024. **1 night with ESPRESSO** in the VLT (ESO, Paranal Observatory) [Visitor Mode]
- Aug 2022. **6 nights with HARPS** in the 3.6 m telescope (ESO, La Silla Observatory) [Visitor Mode]

**Accepted observing programs:**

- **8 programs as PI** [including one DDT at ESO]**: 40 CHEOPS orbits** (ESA); **8.6 h with SPHERE** in the VLT (ESO, Paranal Observatory); **4 h with GRAVITY** in the VLTI (ESO, Paranal Observatory); **74 h with CARMENES** in the 3.5 m telescope (CAHA Observatory)
- **10 program as co-PI: NIRPS & HARPS** in the 3.6 m telescope (ESO, La Silla Observatory) [PI: J. Lillo-Box]; **ESPRESSO** in the VLT (ESO, Paranal Observatory) [PI: J. Lillo-Box; and J. Faria]; Two **CHEOPS** proposals (ESA) [PI: J. Lillo-Box]; **CARMENES** in the 3.5 telescope (CAHA Observatory) [PI: C. Cifuentes; L. Lillo-Box; A. Castro-González; and a large-program (***KOBE***), PI: J. Lillo-Box]; **CAFOS** in the 2.2 m telescope (CAHA observatory) [PI: A. Castro-González]; **CAFÉ** in the 2.2 m telescope (CAHA observatory) [PI: J. Lillo-Box]

## Dissemination

### Seminars

(1) **Geneva Observatory** [Apr 2025] *The TROY project: do co-orbital exoplanets really exist?*

(2) **Liege University** [Mar 2025] *The TROY project: do co-orbital exoplanets really exist?*

(3) **ESA exoplanet team at Madrid** [Oct 2024] *The TROY project: do co-orbital exoplanets really exist?*

(4) **ESO headquarters at Santiago de Chile** [Nov 2022] *KOBEsim. Bayesian observing strategy algorithm for planet detection in RV surveys*

(5) **ESO headquarters at Santiago de Chile** [Aug 2022] *PiGs. Planets in Giant stars*

### Conferences

#### Talks

(1) **Detection and Dynamics of Exoplanets** [Coimbra, Jul 2025] *Looking closer at PDS 70: Tracing Trojan dust?*

(2) **Madrid-Area Exoplanet Science Meeting at ESAC** [Madrid, Dec 2024] *The KOBE experiment. First results*

(3) **Bay Area Exoplanets Meeting** [Santa Cruz California, Jul 2024] *The TROY project: co-orbital exoplanets and how to find them*

(4) **Other Worlds Laboratory Summer Program 2024** [California, Jul 2024] *Developing Moca to compute mock RVs induced by exoplanets*

(5) **Coomot 2** [Milan, Mar 2024] *Are there three bodies? Low-mass stars, transiting planets and Trojan companion candidates*

(6) **Keep uPhDated CAB** [Madrid, Dec 2023] *Genesis of Trojans in PDS 70 b potentially hunted with ALMA*

(7) **Toward Other Earths III** [Porto, Jul 2023] *Genesis of Trojans in PDS 70 b potentially hunted with ALMA*

(8) **PhD meetings UCM** [Madrid, Mar 2023] *Exotrojan planets. Missing pieces of planetary formation*

(9) **Keep uPhDated CAB** [Madrid, Dec 2022] *Exotrojan planets. Missing pieces of planetary formation*

(10) **Madrid-Area Exoplanet Science Meeting at ESAC** [Madrid, Oct 2022] *In the search for exotrojan planets*

(11) **Spanish Society of Astronomy XV at IAC** [Tenerife, Sep 2022] *The KOBE experiment - KOBEsim: improving RV detection through efficient scheduling*

#### Posters

(1) **Extremely Precise Radial Velocities 6** [Porto, Jun 2025], *Exotrojans around low-mass stars: A search with a RV clock*

(2) **Extremely Precise Radial Velocities 6** [Porto, Jun 2025], *KOBE-1: A new multi-planetary system around a late K dwarf*

(3) **Complex Planetary Systems II** [Namur, Jul 2023] *Witnessing the genesis of exotrojans in PDS 70* **[Awarded]**

(4) **ESLAB 2023 in ESTEC** [Noordwijk, Mar 2023] *Towards completing extrasolar systems with the TROY project*,

(5) **Spanish Society of Astronomy XV at IAC** [Tenerife, Sep 2022] *The KOBE experiment - KOBEsim: improving RV detection through efficient scheduling*

(6) **LATSIS 22 in ETH** [Zurich, Sep 2022] *Co-orbital worlds as possible bullets of giant impacts*

### Technical talks

- **PyCoffee at CAB** [Jan 2025] *Regular expressions for a more efficient work*
- **Journal club at CAB** [Madrid, Nov 2024] about *DSHARP VII. The Planet-Disk Interactions Interpretation*
- **PyCoffee at CAB** [Madrid, Mar 2024] *Start doing your own Python modules*

### Outreach and media

- **Nacional Radio and international written interviews** on my research [see for example *Onda Regional*, *Radio Extremadura*, *ABC*, *Science*, *Space*]
- **Press-releases** on my research work [see for example *ESO*, *CAB*, *CAHA*]
- Collaborator in the outreach **YouTube** channel of my research group [*Remote Worlds Lab*]
- **Course on TV, Radio and News Conferences** for researches [17 h, Feb 2025] by the Spanish National Radio and TV (RTVE) and CSIC
- **Writing and speaking courses:** *Writing better proposals and Papers* workshop (by Dr. Artie Hatzes). *Speak in public and present work efficiently* course (UCM)
- **First-authored article for the Revista Española de Física**[to be published, V40] Acercándonos al desierto donde residen los mundos…
- **Four outreach talks in schools** [Madrid, Apr 2025] *Hidden planets in the immense Universe*
- **Co-writer in a scientific blog and instagram content** [Jun 2020 - Jan 2022] *Le dijo un Quark al Cosmos* [not available anymore]

## Organizing experience

- **SOC:** Mini-symposium within Spanish Society of Astronomy XV [Granada, Jul 2024] *Here and There: Synergies between Solar System and Exoplanetary Research*
- **LOC:** *Exploring Tatooine and beyond: Circumbinary planets with ESA missions* [Madrid, (to be) Dec 2025]
- **PyCoffees:** co-organizer at CAB [Madrid, since Nov 2023; *Github repository*]