

## Víctor Almendros-Abad



### Title

Is brown dwarf formation environment-dependent? A case study in NGC 2244

### Abstract

Brown dwarfs (BDs) lie in the substellar mass regime, and are a bridge between stars and planets, thus providing a unique window into the unknowns of their formation processes. The dominant mechanism behind the formation of BDs is still not fully constrained. In fact, BD formation is expected to be affected by the environment in which they are born, in particular, an environment with high stellar densities and/or large number of massive stars would increase the efficiency of BD production compared to stars. In order to test these hypotheses, we are studying the low-mass population of three massive young clusters with extreme environmental properties compared with nearby star-forming regions. One of these clusters is NGC 2244 ( $d=1.5$  kpc), which hosts a large number of OB stars and presents a low stellar density. We have built a robust sample of cluster members using deep photometry, astrometry and multi-object spectroscopy (VIMOS and KMOS/VLT), resulting in the first spectroscopically confirmed BDs beyond 1 kpc. In this talk, I will present our newly developed method for spectroscopic analysis of cool dwarf spectra in the NIR, implementing machine learning models to efficiently separate young members from field contaminants, that will be of special interest for upcoming multi-object facilities such as NIRSPEC and NIRISS/JWST and MOONS/VLT. Furthermore, I will present our results on the BD population in NGC 2244 and compare them with the other massive clusters in our sample, as well as with nearby star-forming regions.

# Víctor Almendros-Abad

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## Education

### Doctorate degree (candidate)

*Brown dwarfs as testbeds for star and planet formation*

Lisboa, Portugal

03/2019–

### Master in Space science and technology

*Thesis: Dry convection models and dust storms in Mars*

Bilbao, Spain

2017–2018

### Bachelor in Physics

*Thesis: Photoluminescence in Silicon wafers using LED illumination*

Valladolid, Spain

2013–2017

## Experience

### Grupo de ciencias planetarias

Bilbao, Spain

*Collaborator*

10/18–01/19

A long-lived and color changing oval on Jupiter's NTrZ

## Publications

**Almendros-Abad, V.**, ... (2021). Youth analysis of near infrared spectra of young low-mass stars and brown dwarfs. eprint arXiv:2110.06368 (accepted at A&A).

Pearson, S., ..., **Almendros-Abad, V.** (2021). The first spectroscopically confirmed brown dwarfs in NGC 2264. MNRAS, 507, 4074.

Kubiak, K., Mužić, K., Sousa, I., **Almendros-Abad, V.**, ... (2021). New low-mass members of Chamaeleon I and  $\epsilon$  Cha. A&A, 650, A48.

Sánchez-Lavega, A., **Almendros, V.**, ... (2019). Basic orbital mechanics from simple observations of the main satellites of Saturn, Uranus and Neptune. European Journal of Physics, 40(3), 035601.

## Meetings and workshops

**8–10/09/21:** *Youth analysis of near infrared spectra of young low-mass stars and brown dwarfs: three case scenarios.* XXXI Astronomy and Astrophysics National Meeting (Online). **Talk**

**2–4/03/21:** *Youth assessment in near infrared spectra of brown dwarfs and very low mass stars: a case study in NGC2244.* Cool Stars 20.5 (Online). **Poster**

**9–11/09/20:** *The effect of the environment in brown dwarf formation: the case study of NGC 2244.* XXX Astronomy and Astrophysics National Meeting (Online). **Talk**

**10–14/02/20:** *Determining youth of low-mass stars and brown dwarfs using low-resolution near infrared spectroscopy.* Tackling the Complexities of Substellar Objects: From Brown Dwarfs to (exo-)Planets (Leiden, Netherlands). **Poster**

**12–13/09/19:** *Youth indicators in near infrared spectra of brown dwarfs and very low mass stars.* XXIX Astronomy and Astrophysics national meeting (Lisboa, Portugal), 12-13 September 2019. **Talk**

**16–20/06/19:** *NIR spectroscopy of NGC 2244 low-mass candidates.* Zooming in on Star Formation (Nafplio, Greece). **Poster**

**10–14/07/18:** *Observando el movimiento de los satélites principales de Saturno, Urano y Neptuno: Una práctica de astrodinámica.* SEA Scientific meeting (Salamanca, Spain). **Poster**

## Schools

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**15–19/11/21:** IAA Severo Ochoa Advanced School on Star Formation (Granada, Spain).

**19–23/07/21:** 2021 Sagan Exoplanet Summer Virtual Workshop, Circumstellar Disks and Young Planets (Online).

**1–5/06/21:** Summer School in Statistics for Astronomers XVI, PennState (Online).

**7–8/09/20:** La Silla Paranal Observatory (LPO) Users workshop (Online).

**20–24/01/20:** Scientific Writing and Communication (Lisboa, Portugal).

**15–29/09/19:** 2019 NEON Observing School (Rozhen, Bulgaria).

## Student advising

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**09/2021–:** *Stellar and substellar population of the massive young cluster NGC 2244.* Paula Brcic, co-supervision of master project.

**09/2021–:** *Spectral characterization of young free-floating planetary mass objects.* Lara Piscareta, co-supervision of master thesis.

**03/2021–:** *Star forming regions as seen by the James Webb Space Telescope.* Niksa Lovric, co-supervision of master thesis.

**09/2020–02/2021:** *Testing the effect of the environment in low-mass star formation: the case of the Rosette nebula.* Bruno Carracedo, co-supervision of bachelor thesis.

## Scholarships

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**09/2019–:** FCT PhD fellowship, *SFRH/BD/143433/2019*

**02–08/2019:** Research fellowship, *PTDC/FIS-AST/28731/2017*

## Meeting organization

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**03/2020–:** Co-organization of weekly journal club of the group project "Young brown dwarfs" (Yo-BD).

**04/2019–:** Active participation in weekly astro-informatics/statistics informal discussions at University of Lisbon.

## Languages

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Spanish (mother tongue), English (C1), Portuguese (B2) and French (A2)