

## Belen Alcalde Pampliega



### Title

Are we missing massive red galaxies at  $z > 3$ ?

### Abstract

The ultimate goal in galaxy studies is to have a complete picture of galaxy formation and evolution across the history of the Universe. A robust determination of the abundance of massive (even quiescent) galaxies at high-redshift is essential to constrain current galaxy formation models.

In this context, this work addresses the challenge of studying the build-up of massive galaxies adding a new population of optically faint (HST-dark) Balmer Break Galaxies (BBGs), which are bright at longer wavelengths (even in the sub-mm regime), to the general population of massive galaxies at  $z > 3$ . We study in detail the physical properties of the general population of known massive galaxies at  $z > 3$  and we analyze the sample of BBGs by comparing them with a mass-limited ( $M > 10^{10} M_{\odot}$  and  $z > 3$ ) sample and a color-selected ( $H - [3.6] > 2.5$ ) sample extracted from the CANDELS catalogs published for these fields.

We have therefore detected a new population of previously unknown optically dark massive red galaxies and provide a more complete sample of the general population of massive galaxies at  $z > 3$ . This population of massive distant galaxies may represent the progenitors of most massive local galaxies. In the context of the current paradigm of galaxy formation, it is essential to constrain and confirm the number density of high redshift massive galaxies, which will provide crucial information to expand our understanding of galaxy evolution. The existence of this numerous population of massive galaxies at high redshifts represents a challenge for existing cosmological models and state-of-the-art simulations.

# Belen Alcalde Pampliega



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European Southern Observatory  
Alonso de Córdova 3107  
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Chile

## Languages

Spanish (native)  
English C1  
French B1

## Computer & astronomical skills

Programming



SQL, Machine learning



IRAF, Top Cat, STILTS,  
Aladin, ds9, VOSPec...



**SED fitting** Synthesizer,  
FAST, EAZY, Pzeta...



Image data analysis



## Scientific interests

**Science Interests:** Galaxy formation and evolution across cosmic time, massive high-redshift galaxies, stellar properties, molecular gas, and dust.

**Technical Interests:** Multiwavelength observations, (sub)-mm single-dish and interferometry observations, machine and deep learning techniques.

## Education & training

**Ph.D. thesis** "The first massive galaxies formed in the universe: selection and characterization of optically faint infrared-bright galaxies in the first 2 Gyr of the universe" defended at Universidad Complutense de Madrid (UCM) in 2020. *Supervisors:* Pablo G. Pérez-González and Guillermo Barro.

**Trainee at ESAC** 'Discovery of binary systems and movement groups in the framework of the Virtual Observatory'. *Supervisors:* Dr. Enrique Solano and Dr. Francisco Jiménez-Esteban. Madrid, 2013-2014.

**AAO research project** 'Coherent guide bundles for adaptive-optics wavefront sensing'. *Supervisor:* Dr. Michael Goodwin. Australian Astronomical Observatory, Sidney 2013.

**Development of a simulator for an optical fiber spectrograph design.** Master thesis at UCM. *Supervisor:* Dr. Armando Gil de Paz. Madrid 2013.

**Master Degree in Astrophysics** [120 ECTS] UCM-UAM. Madrid, 2011-2013.

## Awards & fellowships

**ING Student Fellowship.** Science and Technology Facilities Council at Isaac Newton Group of Telescopes. La Palma 2018-2019.

**FPI-MINECO predoctoral research stay fellowship.** UC. Berkeley 2016. *Supervisor:* Guillermo Barro.

**FPI-MINECO predoctoral fellowship at UCM.** The Spanish Ministry of Economy and Competitiveness (MINECO). *PI:* Pablo G. Pérez-González.

**Young graduate trainee fellowship.** European Space Astronomy Center, Madrid 2013-2014.

**AAO fellowship.** Sydney 2013.

## Professional experience & teaching

**Support astronomer at INT** [ING]. La Palma, 2018-2019.

**Telescope Operator training at WHT** [ING]. La Palma, 2019.

**Astronomy Lab** for undergraduate students from SUFFOLK Univesity. Tenerife, 2018.

**Physics Laboratory Lecturer** [5.4 ECTS] for undergraduate students at UCM, 2015-2017.

## Main publications

**Optically-faint massive Balmer Break Galaxies at  $z>3$  in the CANDELS/ GOODS fields** Belén Alcalde Pampliega, Pablo G. Pérez-González, Guillermo Barro.

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