

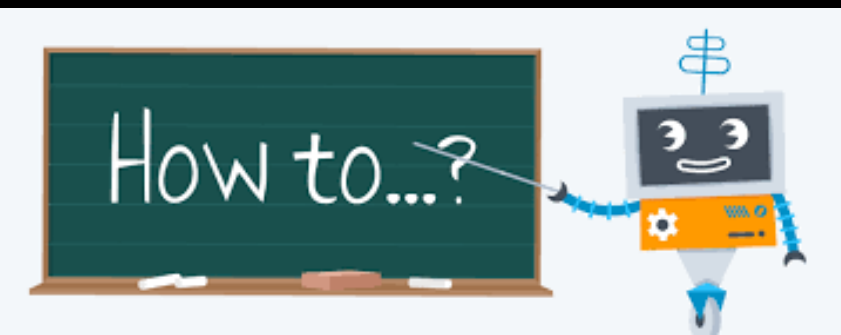
# CoAstro: @n Astronomy Condo

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- ... open science to audiences with low astronomy awareness?
- ... flow, with lasting effects, scientific knowledge and processes?
- ... change astronomers, science communicators and lay public perceptions about each others?
- ... assess all these things?
- ... do it , without self-funding or self human resources?

# Who am I?



**Middle and high school portuguese teacher for 20 years.**

**I have been deployed to Porto Planetarium – Ciência Viva Center since 2016.**

**I'm a science education and communication researcher at the Institute of Astrophysics and Space Sciences**

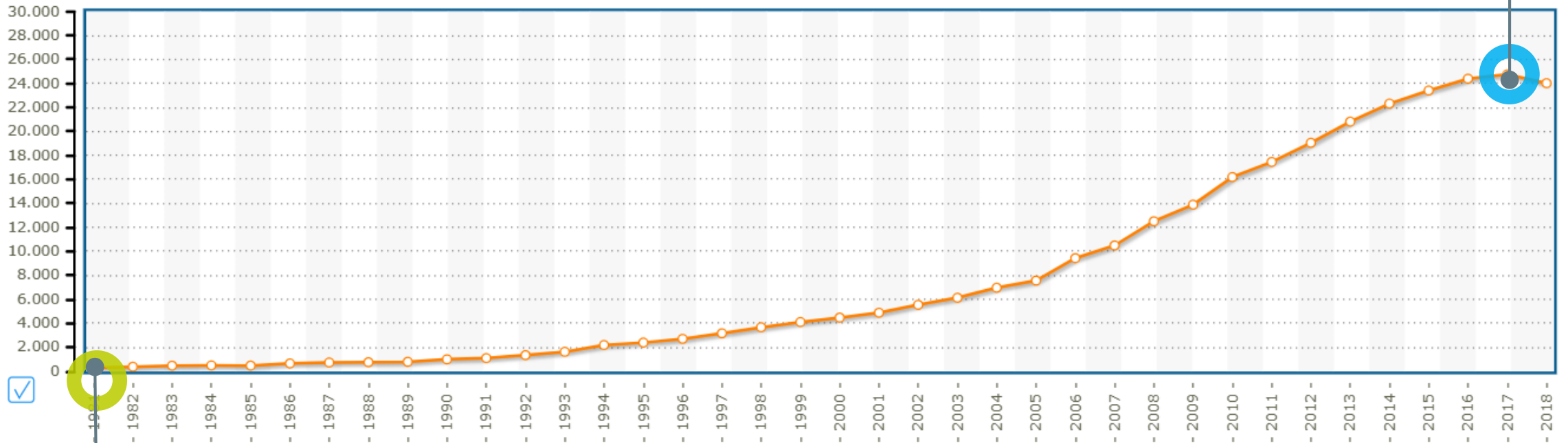


# Some school dilemmas



24748  
(2017)

## Number of papers published in Portugal per year



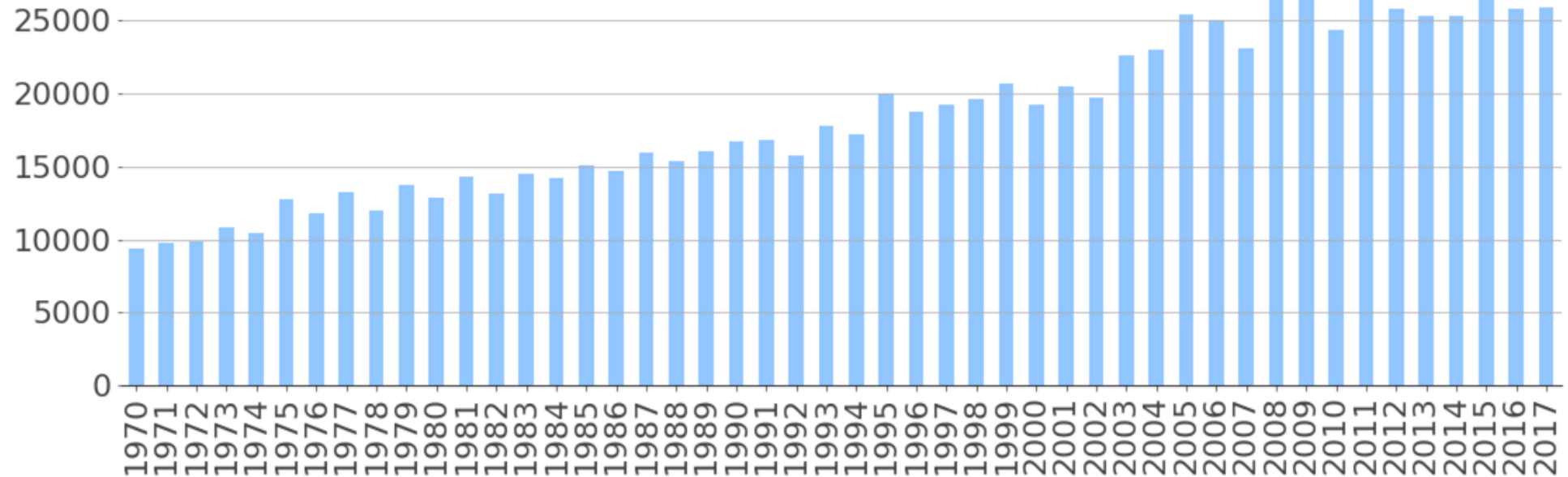
308  
(1981)

Pordata (2020)

# Some school dilemmas



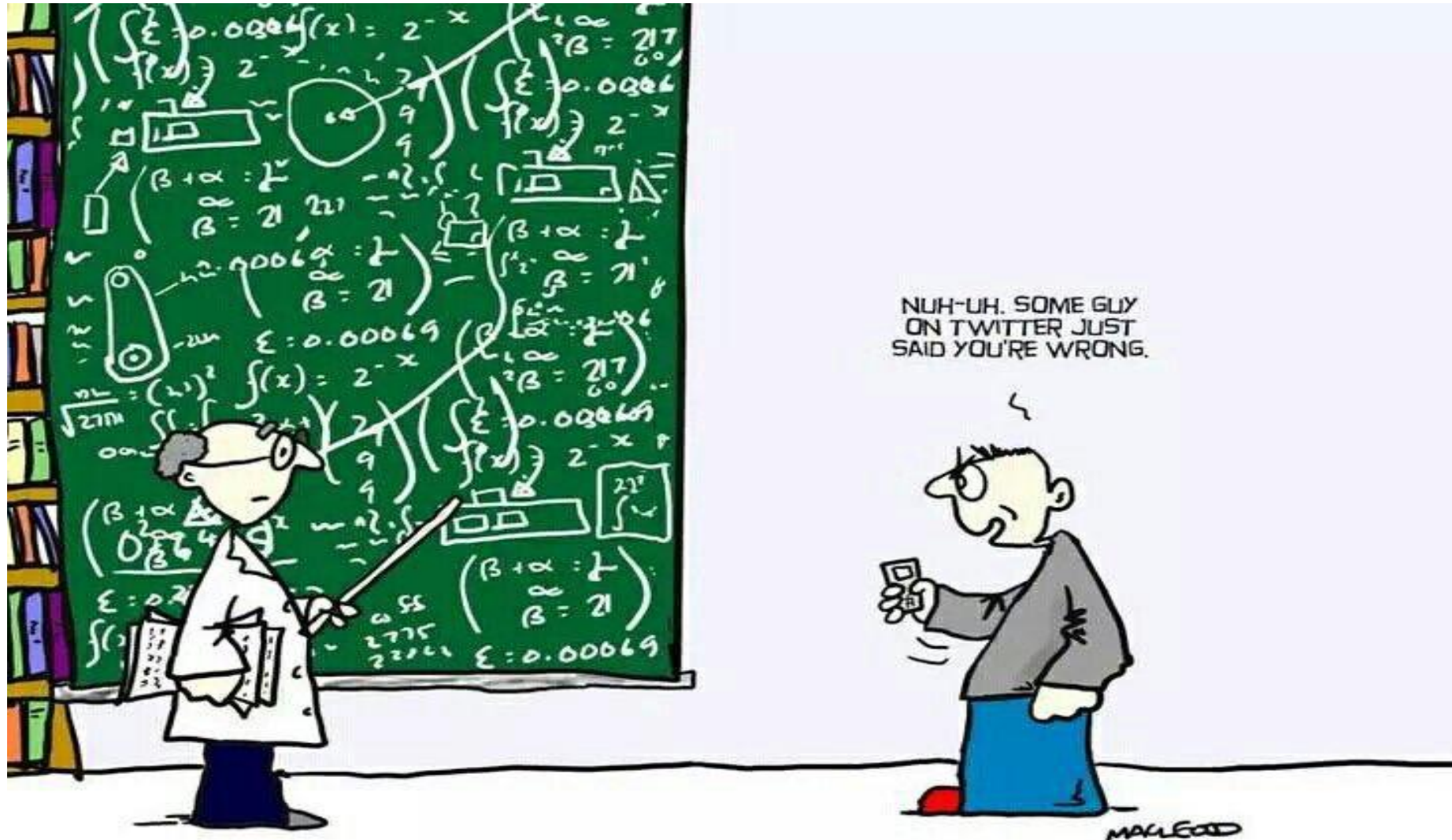
## Indexed records in NASA's Astrophysics Data System (ADS)



(GGS, 2020)

**How many have reached non-specialized audiences?  
When does it reach those audiences?  
...and when something reaches, only results do!**

# But only knowing the results...



**False science**

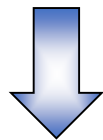
**Bad science**

**Fake news**

(Baker, 2016; Ioannidis, 2005)

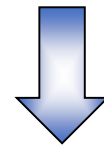
# Some others dilemmas...

Researchers



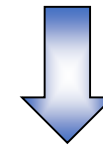
Funding  
Human resources

Science communicators



Range

Interested public



Engagement  
Costs

A citizen science project with some special features...



# COASTRO: @N ASTRONOMY CONDO

See how astronomers, science communicators and teachers put astronomy in the daily lives of children and their families



# CoAstro: @n Astronomy Condo



**5 astronomers**



**4 science communicators**

**1**



**9 elementary teachers**

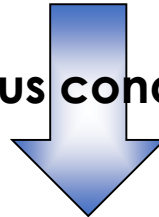
Almost 1000 direct participants  
No possibility of estimating indirect ones  
Without self-funding

# We started with...

**Atitudes**

Osborne, Simon, e Collins (2003); Price e Lee (2013)

**previous condition for...**



**Understanding and  
engagement**

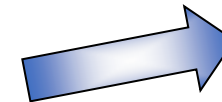
Holden (2002); Oliveira & Carvalho (2015)

# We used citizen science as...

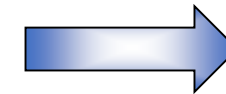


Investigation technique

Science communication method



“School effect”



“Teacher effect”

(Bressoux, 2003; da Fonseca, 2011; Gilbert, Bulte, & Pilot, 2011; Heafner, 2019)

# Investigation technique

## 1<sup>st</sup> stage: astronomy research

Astronomers  
had the main  
role



Teachers were  
research  
partners



# How have we done it?



**Planets  
project**

Video of a planetary transit

↑  
*Python* program

Exoplanets detection

↑  
Light curves analysis

**Participation  
in astronomy research**

**Stars  
project**

↓  
Analysis of standard stellar spectra

↓  
*Data Release 2* of GAIA mission (ESA)

↓  
57000 stars composition

↓  
Brightness correction



# Then...

## 2<sup>nd</sup> stage: science communication

Teachers had the main role



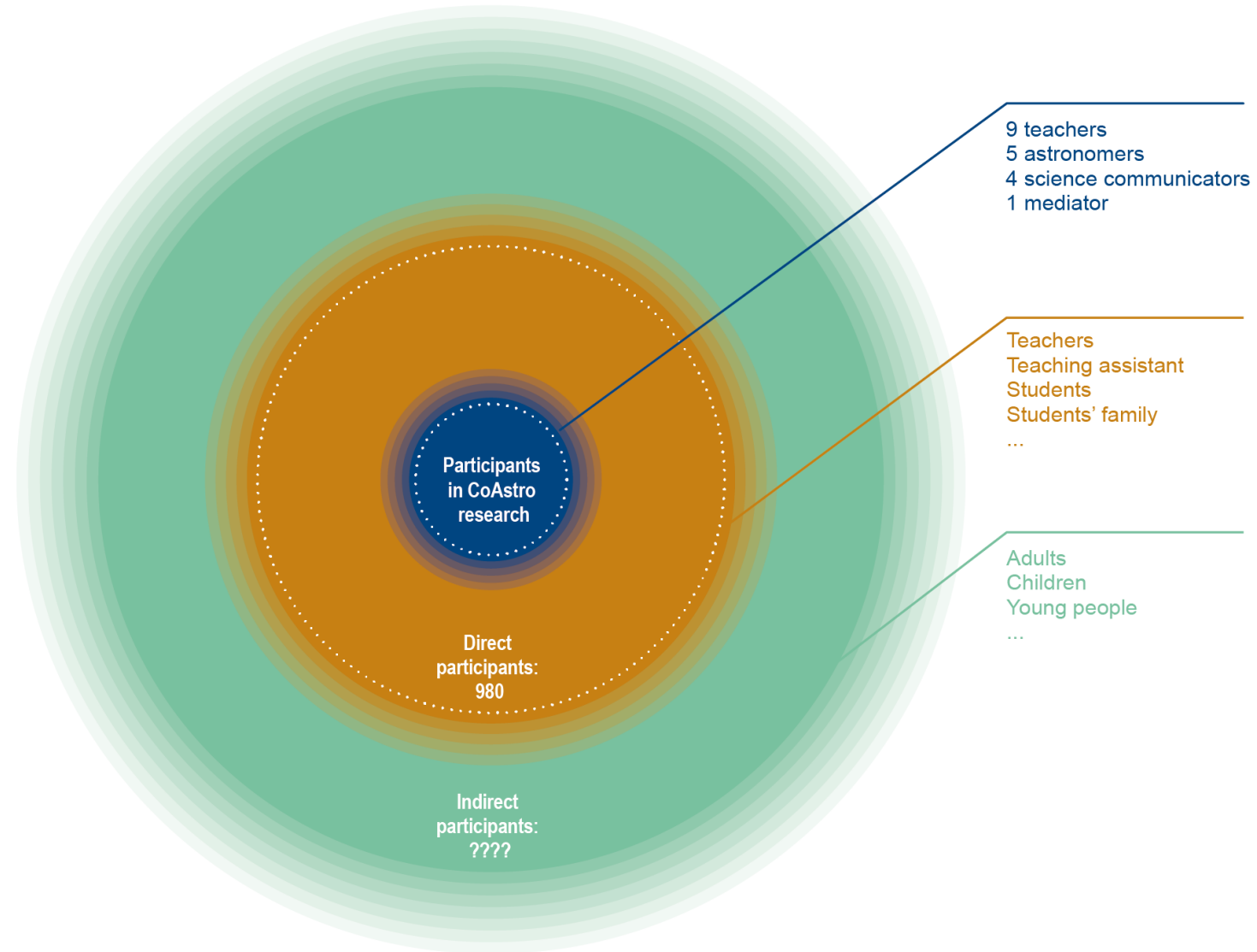
Astronomers and science communicators were collaborators



# CoAstro's assessment



- Qualitative research
- Case study
- Techniques of data collection:
  - Interviews;
  - Surveys;
  - Participant observation;
  - Document analysis.



# CoAstro's special features – the roles



A CS with astronomers, lay public but also, with science communicators

A mediated CS by someone close and knowledgeable about the participants' professional contexts

Horizontal face-to-face interactions (group and bilateral interactions)

An “open project”: the participants cocreated CoAstro's according to their (scientific, educational...) needs





# CoAstro's special features – the design



A CS (also) as a science communication method

A CS that aimed engagement but, also, awareness and understanding of scientific content and processes

A CS that, through school, aims audiences with low astronomy awareness

A CS that allowed an “open school”:  
- to science research and dissemination  
- to itself and to its surroundings

Without self-funding or self human resources

# CoAstro's special features – the outputs



Cornell University

arXiv.org > astro-ph > arXiv:1909.09094

Astrophysics > Earth and Planetary Astrophysics

[Submitted on 19 Sep 2019 (v1), last revised 13 Jan 2020 (this version, v2)]

### Planet Hunters TESS I: TOI 813, a subgiant hosting a transiting Saturn-sized planet on an 84-day orbit

N. L. Eisner, O. Barragán, S. Aigrain, C. Lintott, G. Miller, N. Zicher, T. S. Boyajian, C. Briceño, E. M. Bryant, J. L. Christiansen, A. D. Feinstein, L. M. Flor-Torres, M. Fridlund, D. Gandolfi, J. Gilbert, N. Guerrero, J. M. Jenkins, K. Jones, M. H. Kristiansen, A. Vanderburg, N. Law, A. R. López-Sánchez, A. W. Mann, E. J. Safron, M. E. Schwamb, K. G. Stassun, H. P. Osborn, J. Wang, A. Zic, C. Ziegler, F. Barnes, S. J. Bean, D. M. Bundy, Z. Chetnik, J. L. Dawson, J. Garstone, A. G. Stenner, M. Hutten, S. Larish, L. D. Melanson, T. Mitchell, C. Moore, K. Peltsch, D. J. Rogers, C. Schuster, D. S. Smith, D. J. Simister, C. Tanner, I. Terentev, A. Tsymbal

We report on the discovery and validation of TOI 813b (TIC 5525572 b), a transiting exoplanet identified by citizen scientists in data from NASA's Transiting Exoplanet Survey Satellite (TESS) and the first planet discovered by the Planet Hunters TESS project. The host star is a bright ( $V = 10.3$  mag) subgiant ( $R_* = 1.94 R_\odot$ ,  $M_* = 1.32 M_\odot$ ). It was observed almost continuously by TESS during its first year of operations, during which time four individual transit events were detected. The candidate passed all the standard light curve-based vetting checks, and ground-based follow-up spectroscopy and speckle imaging enabled us to place an upper limit of  $2M_{Jup}$  (99% confidence) on the mass of the companion, and to statistically validate its planetary nature. Detailed modelling of the transits yields a period of  $83.8911^{+0.0027}_{-0.0031}$  days, a planet radius of  $6.71 \pm 0.38 R_\oplus$ , and a semi-major axis of  $0.423^{+0.031}_{-0.037}$  AU. The planet's orbital period combined with the evolved nature of the host star places this object in a relatively under-explored region of parameter space. We estimate that TOI-813b induces a reflex motion in its host star with a semi-amplitude of  $\sim 6 \text{ ms}^{-1}$ , making this system a promising target to measure the mass of a relatively long-period transiting planet.



Scientific, educational and dissemination outputs

The increasing of the understanding about key astronomy content (not only specific one)

Changes in participants' attitudes and beliefs towards science

Changes in participants' perceptions about each other, about science communication and science education

# Some results



## Teachers

Changes in attitudes and beliefs towards astronomy

Gains in substantive and procedural knowledge

Increase in the quality of scientific dissemination practices

## Astronomers and science communicators

CoAstro impacted research and astronomy dissemination and the way of structuring them

CoAstro reinforced their perception about the importance and purposes of science communication practices

CoAstro promoted new personal communication skills

# With CoAstro we saw that...



Citizen science is (also) an unparalleled method for science communication

Schools are suitable environments to flow, with efficiency and agility, scientific results and processes

Schools are means to reach audiences with low astronomy awareness and accomplish long-lasting effects

Its model can be used in other contexts and with other sciences

**It is the first citizen science project of this kind!**

Thank you



# **CoAstro: @n Astronomy Condo**

**A venture that puts astronomers,  
science communicators  
and elementary teachers,  
in the (same) space.**



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