

The ExoClock Project

Pro-Am Collaboration For Ground-Based
Observations In Support Of The ARIEL Space
Mission

Anastasia Kokori

UCL, Birkbeck



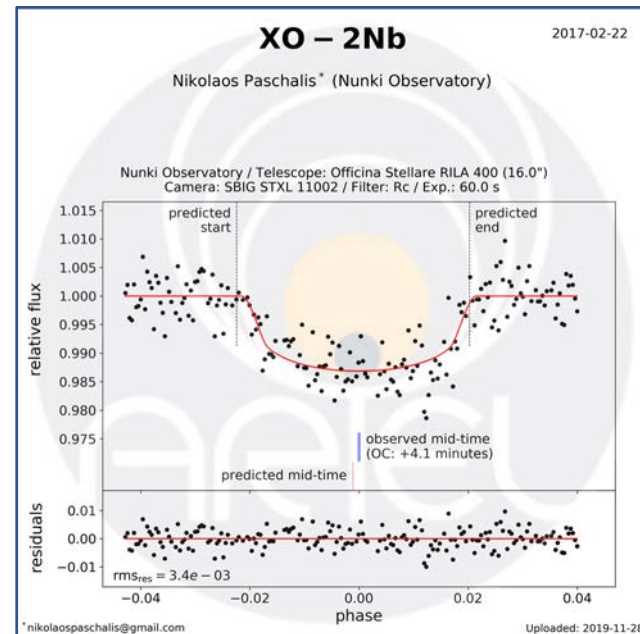
Introduction

What is ExoClock?

- An open platform
- Service for ephemerides
- Citizen Science project

Scope:

- Ephemeris refinement to increase mission efficiency



Why?



- The current targets have uncertainties which are gradually increasing.
- The future targets have already big uncertainties.

An integrated platform

1. Space data

for targets that are not accessible from the ground
(Billy Edwards, UCL)

2. Literature data

Integrating all current and future papers
(everyone)

3. Ground networks

- **Telescope live**
(Marco Rocchetto & Hamish Caines, UCL)
- **Synergy with the ETS**
(Rob Zellem, JPL)
- **ExoClock network**
(Anastasia Kokori, UCL)

An interactive platform

➤ Exoplanet Characterization Catalogue (ECC)

known targets
in the MRS

currently 370

ARIEL SPACE MISSION
European Space Agency's Mission

ExoClock ▾ Ephemerides My Profile ▾ My Schedule ▾ My Lab ▾ Admin Lab ▾

HAT-P-22b

The Star					
Simbad	HD 233731				
GAIA	DR2 846946629987527168				
ZMASS	J10224361+5007420				
RA	10:22:43.5924	DEC	+50:07:42.063		
Parallax	P.M. RA	P.M. DEC			
12.201 mas	-26.182 mas/y	83.727 mas/y			
V _{mag}	R _{mag}	I _{mag} *	J _{mag}	H _{mag}	K _{mag}
9.76	9.44	8.905	8.293	7.935	7.837
G _{mag}	GRP _{mag}	GRP _{mag}			
9.519	9.949	8.961			

* calculated from GAIA magnitudes

The Planet

Discovered by [Bakos et al. 2010](#)
Ephemeris by [Bakos et al. 2011](#)
Priority by **HIGH**

Mid-time
2454930.22078 ± 0.00025 BJD_{TDB}

Period
3.21222 ± 9e-06 days

R_{band} Depth* **Duration***
14.41 mmag 2.88 hours

* calculated from the parameters below, using PyLightcurve

Limb Darkening Parameters

T _{eff}	Log(g)	Fe/H
5302 K	4.4 cm/s ²	0.24 dex

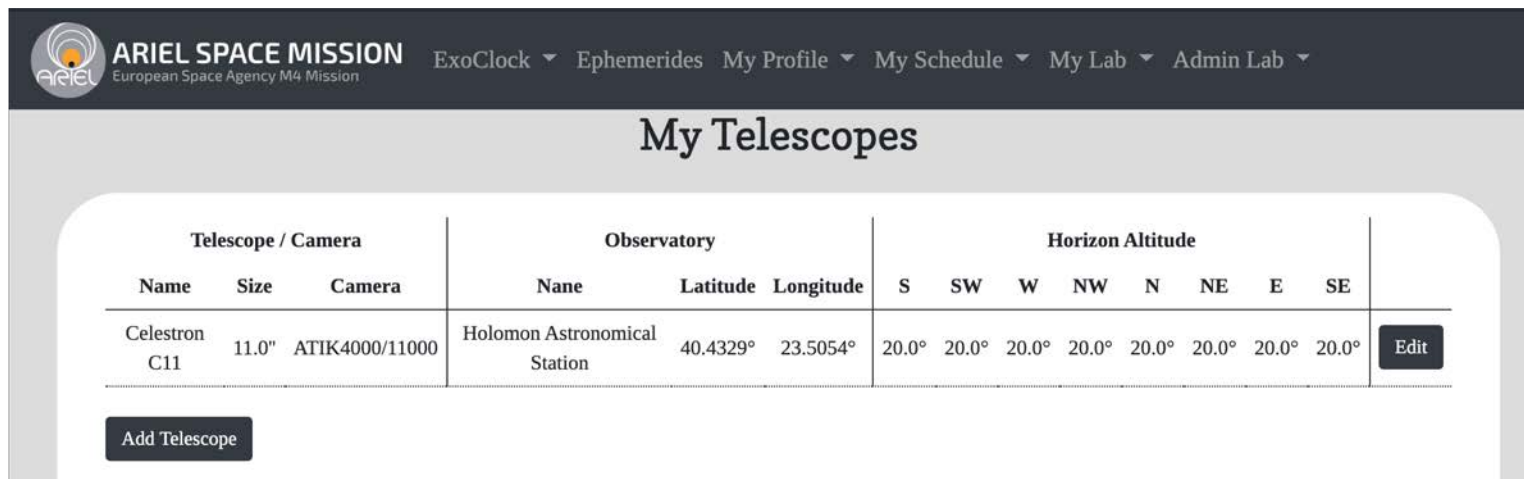
Transit Parameters

R _p /R _s	a/R _s
0.10630631	8.597

i	e	ω
86.9 deg	0.02	0.0 deg

An interactive platform

- Scheduler based on the user telescope, location, site horizon, and the ECC



The screenshot shows the ARIEL Space Mission website interface. At the top, there is a navigation bar with the ARIEL logo and the text 'ARIEL SPACE MISSION European Space Agency M4 Mission'. To the right of the logo are several menu items: 'ExoClock', 'Ephemerides', 'My Profile', 'My Schedule', 'My Lab', and 'Admin Lab'. Below the navigation bar is a section titled 'My Telescopes'. This section contains a table with columns for 'Telescope / Camera', 'Observatory', and 'Horizon Altitude'. The 'Telescope / Camera' column is further divided into 'Name', 'Size', and 'Camera'. The 'Observatory' column is divided into 'Name', 'Latitude', and 'Longitude'. The 'Horizon Altitude' column is divided into 'S', 'SW', 'W', 'NW', 'N', 'NE', 'E', and 'SE'. A single row of data is visible, representing a Celestron C11 telescope at the Holomon Astronomical Station. An 'Add Telescope' button is located below the table, and an 'Edit' button is located to the right of the data row.

Telescope / Camera			Observatory			Horizon Altitude								
Name	Size	Camera	Name	Latitude	Longitude	S	SW	W	NW	N	NE	E	SE	
Celestron C11	11.0"	ATIK4000/11000	Holomon Astronomical Station	40.4329°	23.5054°	20.0°	20.0°	20.0°	20.0°	20.0°	20.0°	20.0°	20.0°	Edit

[Add Telescope](#)

An interactive platform

- Target Prioritization – target $1\sigma = 1/12 D$ to ensure that $0.5 D$ will be observed before and after transit (D : transit duration)

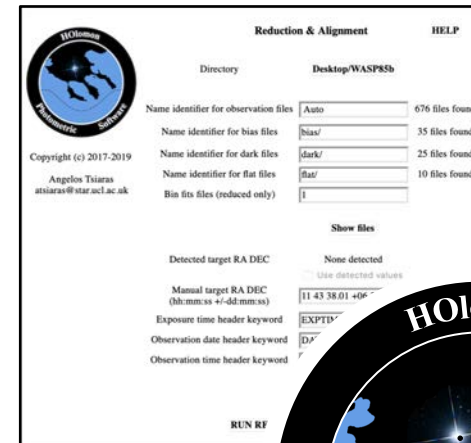
Planet	Star		Transit		Observing times [UTC+1.0] and target position				
	RA/DEC J2000	R _{mag} mag	R _{band} Depth mmag	Duration hours	1h Before Ingress	Transit Start	Mid Transit	Transit End	1h After Egress
KELT-18b LOW PRIORITY	14:26:05.7574 +59:26:39.288	9.941	9.02	4.66	2020/01/14 22:21 22° NE	2020/01/14 23:21 28° NE	2020/01/15 01:40 44° NE	2020/01/15 04:00 62° NE	2020/01/15 05:00 68° NE
WASP-65b MEDIUM PRIORITY	08:53:17.8286 +08:31:22.811	11.525	16.82	2.75	2020/01/15 00:44 58° S	2020/01/15 01:44 55° SW	2020/01/15 03:06 45° SW	2020/01/15 04:29 31° W	2020/01/15 05:29 20° W
WASP-14b MEDIUM PRIORITY	14:33:06.3573 +21:53:40.982	9.465	12.16	2.64	2020/01/15 01:04 22° E	2020/01/15 02:04 33° E	2020/01/15 03:23 48° E	2020/01/15 04:42 62° SE	2020/01/15 05:42 70° SE

Features

➤ Observation Guidelines

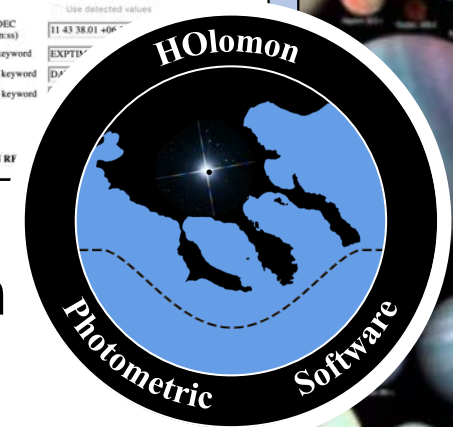
➤ Tools/ Software

www.exoworldspies.com



➤ Online Fitting and validation by our team

➤ Ephemeris Update using all available data

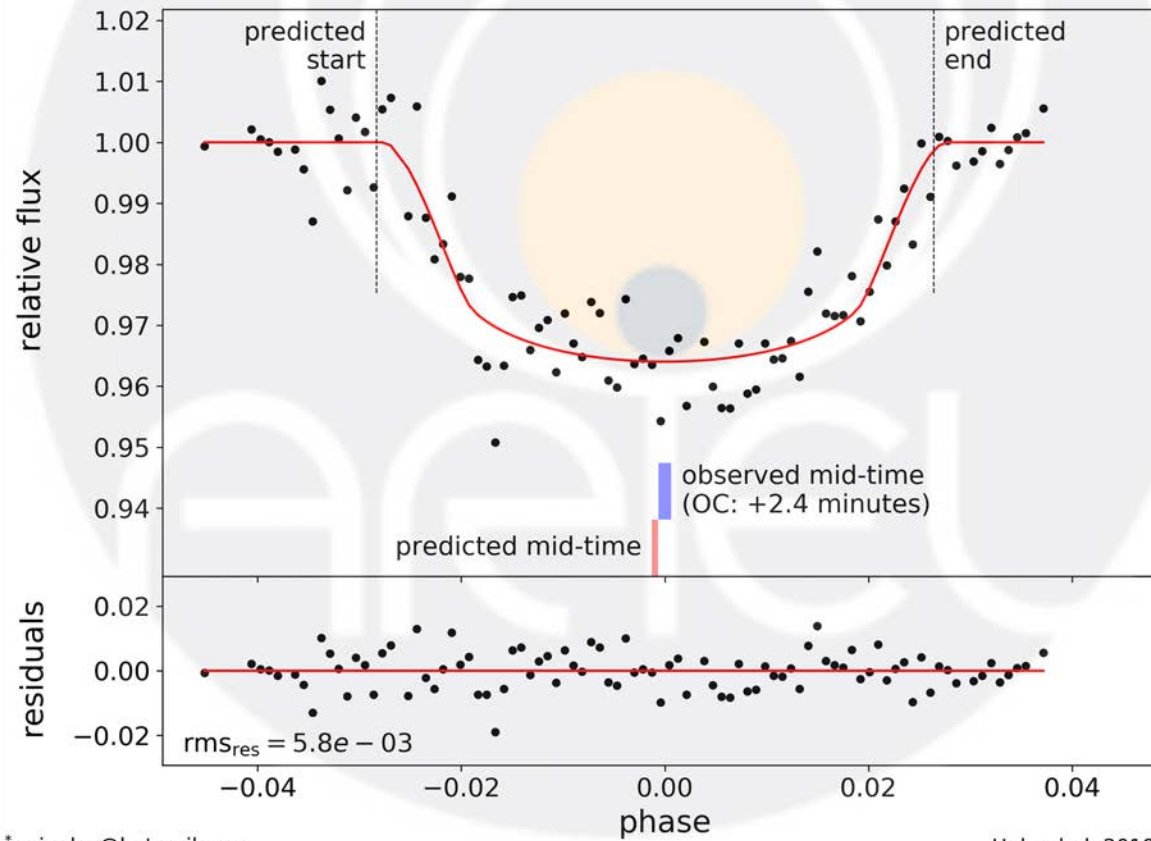


CoRoT – 2b

2019-07-08

Nick Sioulas* (NOAK Observatory)

NOAK Observatory / Telescope: SKYWATCHER (10.0")
Camera: ATIK 460exm / Filter: R / Exp.: 120.0 s



*nsioulas@hotmail.com

Uploaded: 2019-09-25

In a few words ...



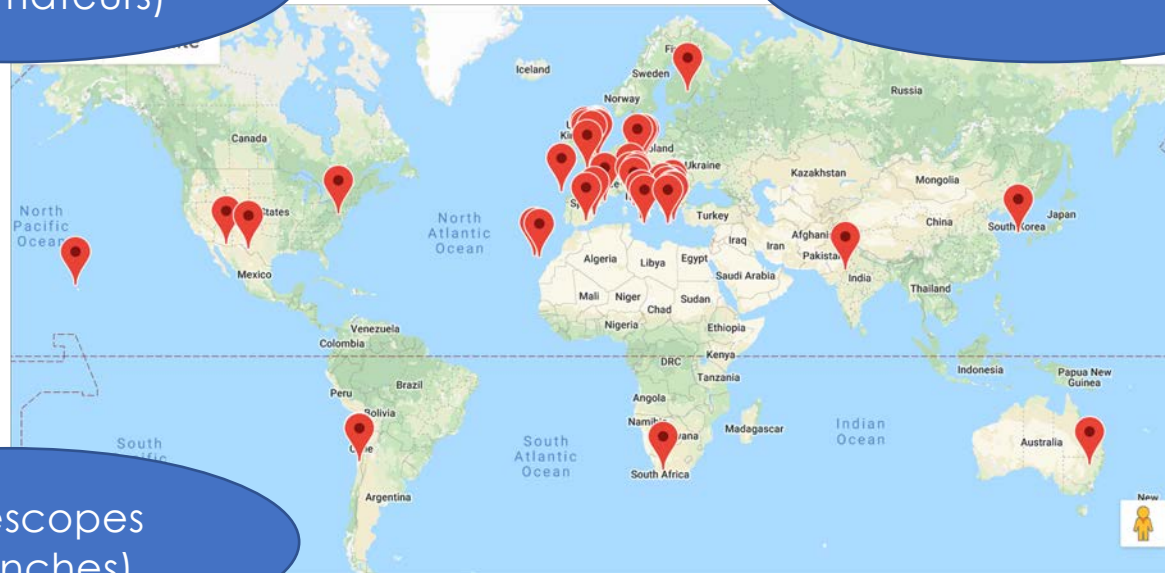
- ExoClock is open to everyone
- It has double role: Service & Outreach
- All observers are co-authors
- Users get feedback, personalized schedule & monthly newsletters

Current Status

Launched in EPSC - September 2019

51 participants
(75% amateurs)

12 countries



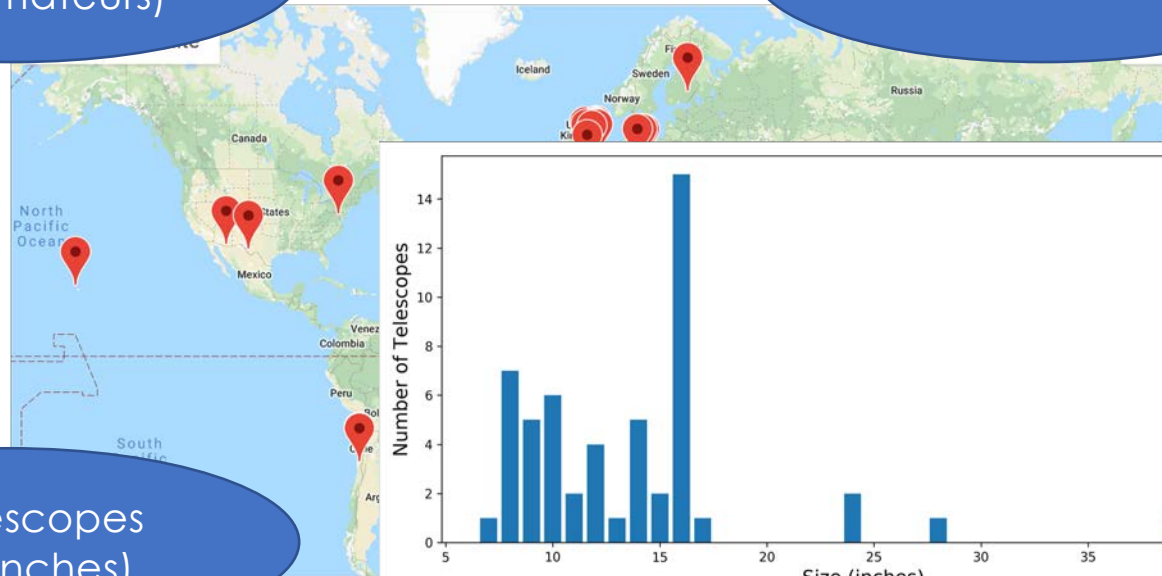
59 telescopes
(7-40 inches)

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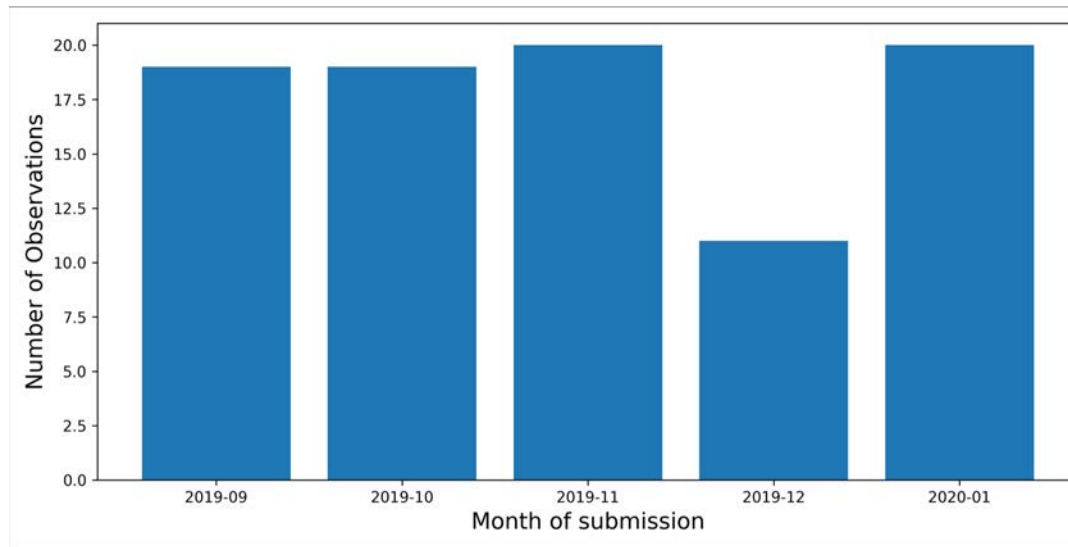
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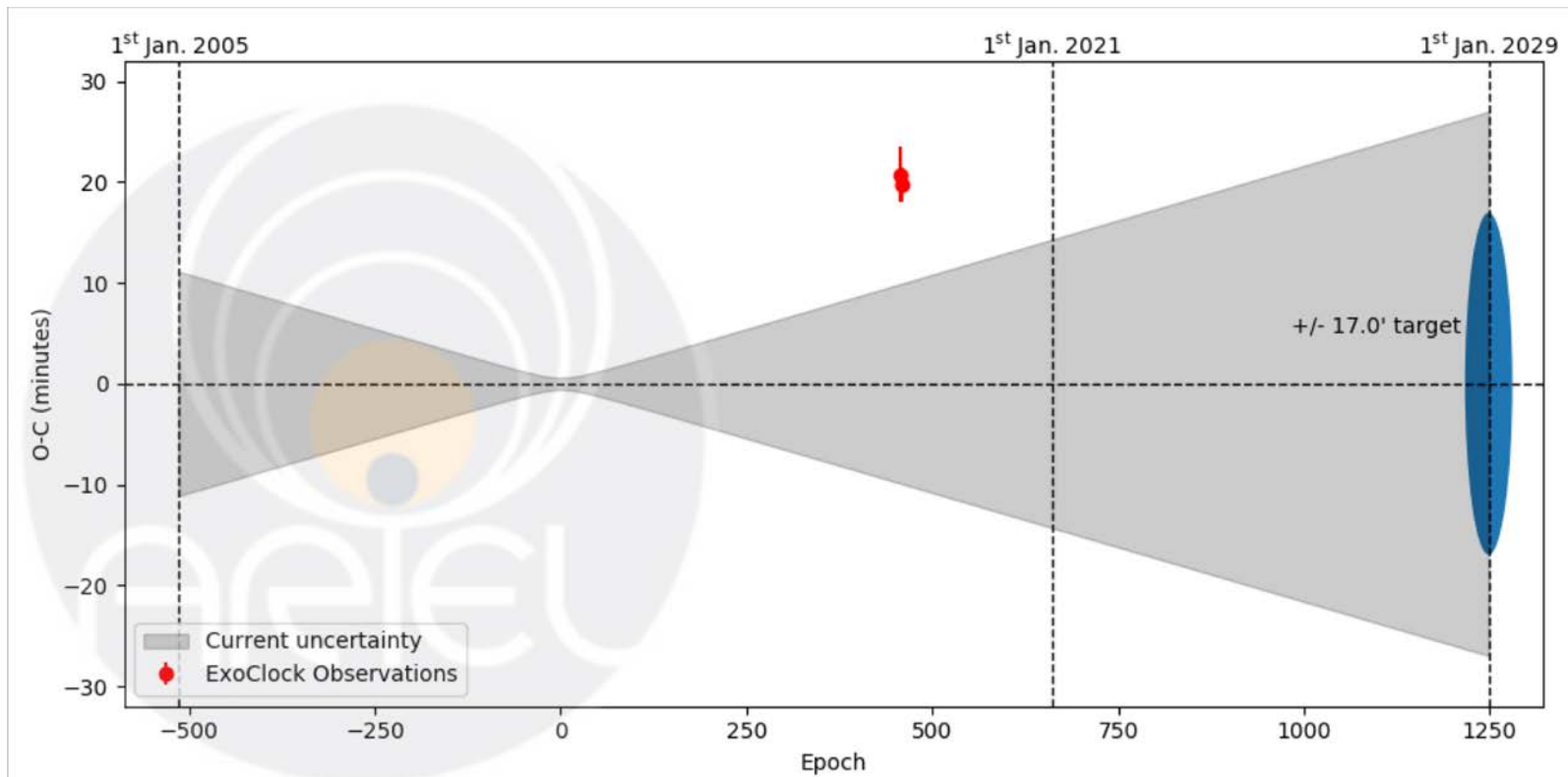
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90 observations

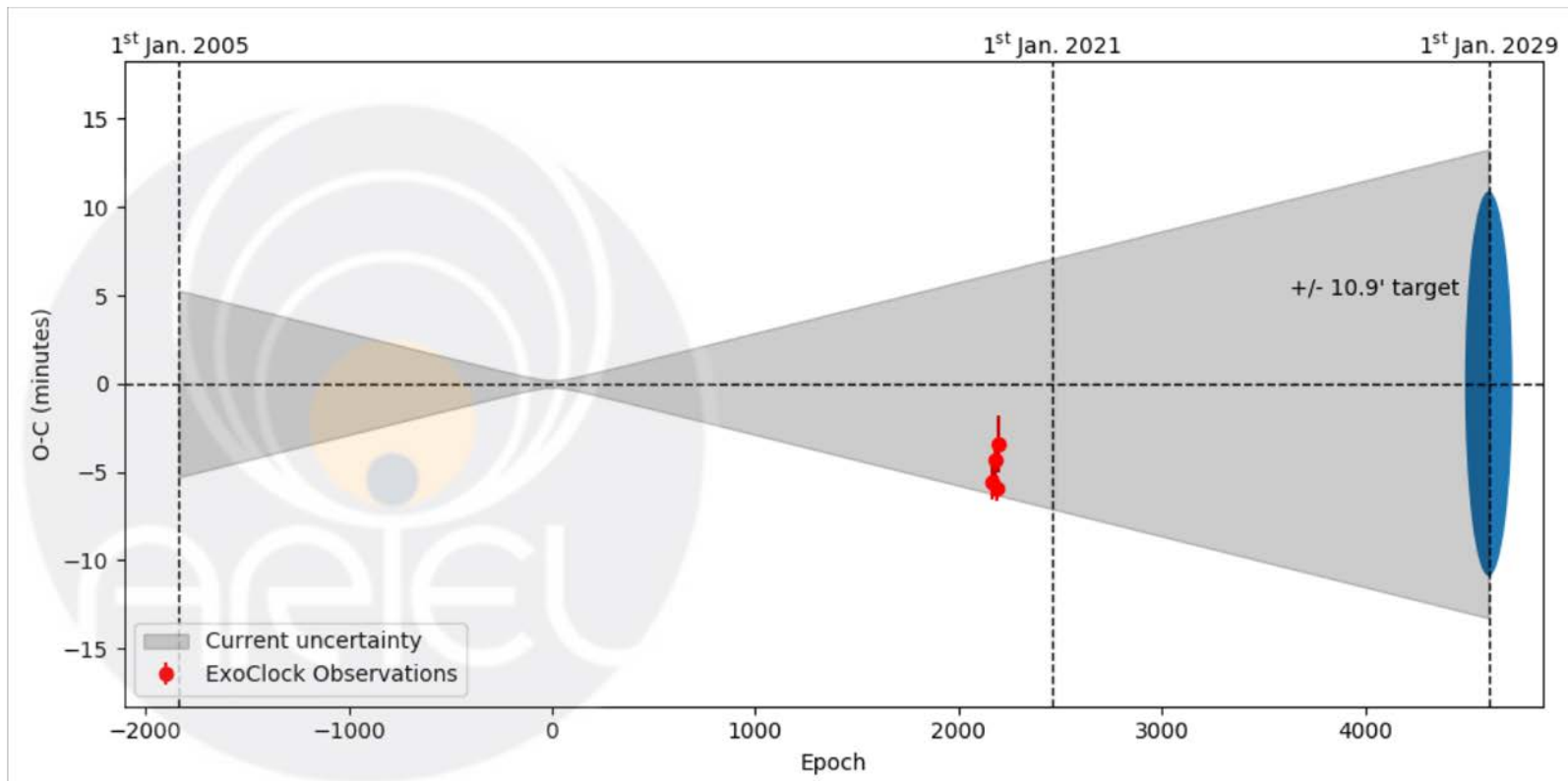
43 targets
out of the 370



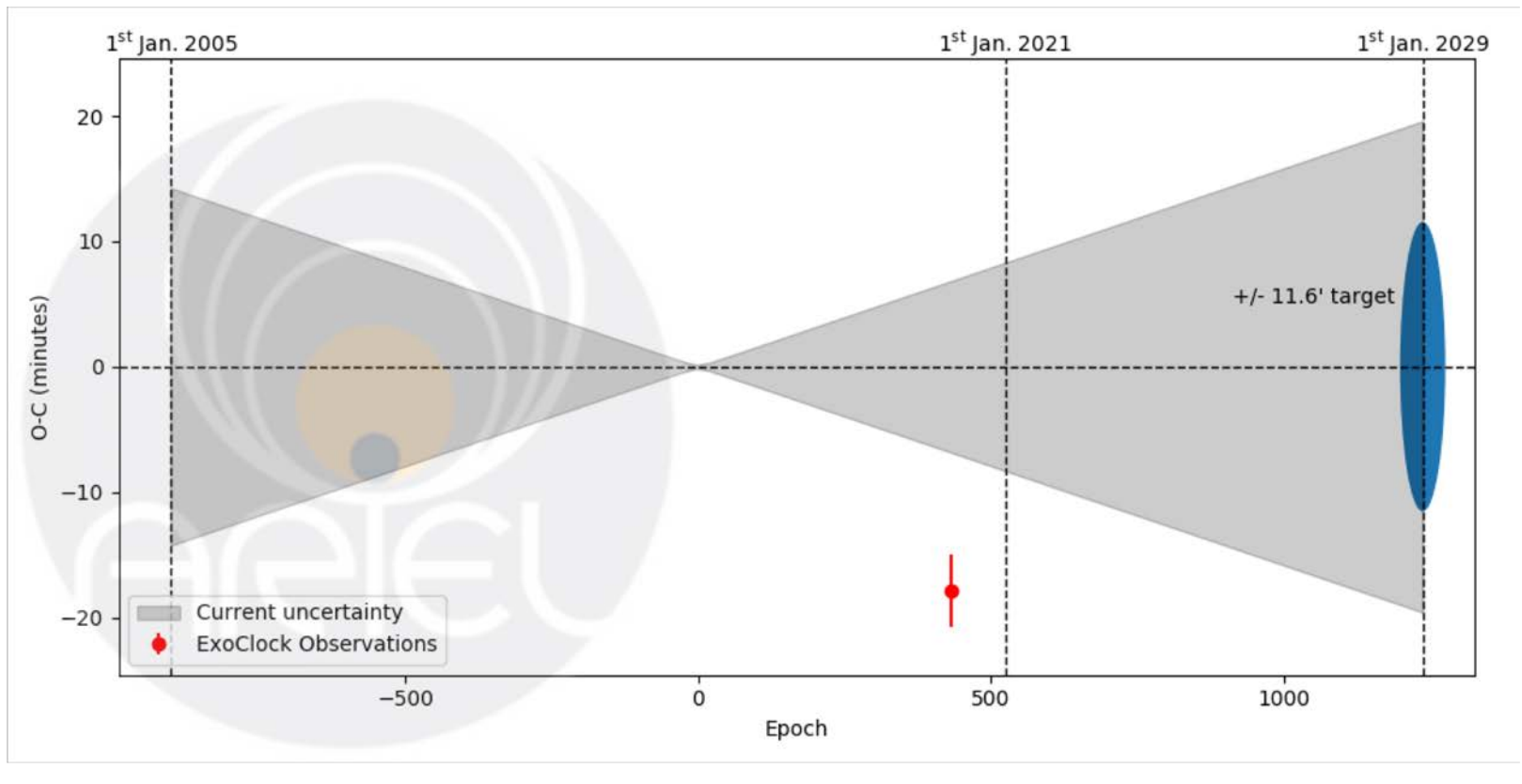
WASP-83b



WASP-77b



K2-30b



Conclusion

Join the ExoClock project & share it!

- **Every transit counts**
- **Small telescopes are useful**



Register at ExoClock:
exoclock.space

Start training at ExoworldsSpies:
www.exoworldsspies.com



You can register to the Monthly Newsletters