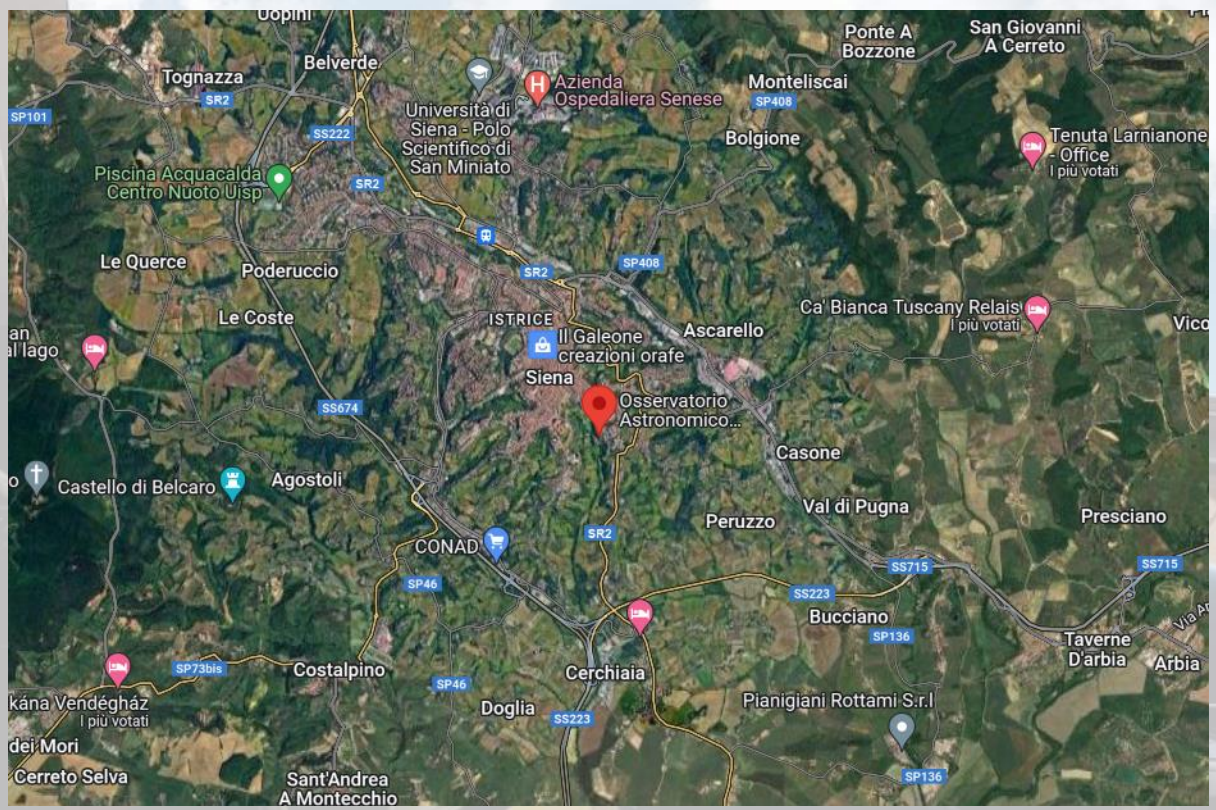
Research with a 30 cm telescope at the Astronomical Observatory of the University of Siena

Alessandro Marchini

Università degli Studi di Siena, DSFTA, Osservatorio Astronomico

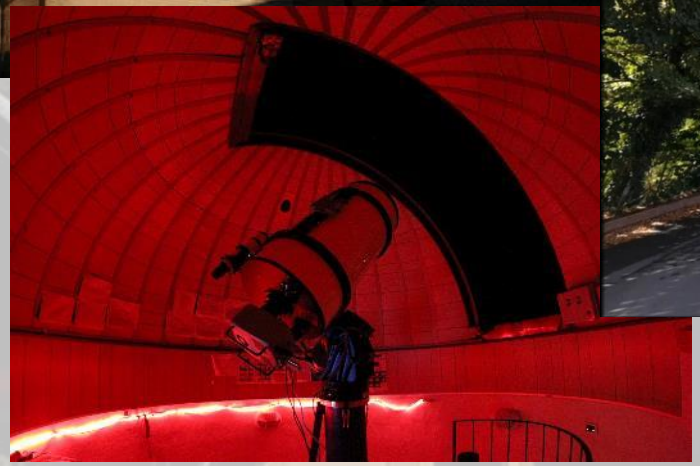
INAF – Osservatorio Astronomico di Brera

Where we are


Ponte A Bozzone
San Giovanni A Cerreto
Tognazza
Belverde
Azienda Ospedaliera Senese
Monteliscai
SP408
SP101
SR2
SS222
Università di Siena - Polo Scientifico di San Miniato
Bolgione
Tenuta Larnianone - Office
I più votati
Piscina Acquacalda Centro Nuoto Uisp
Le Querce
Poderuccio
Le Coste
ISTRICE
Ca' Bianca Tuscany Relais
I più votati
Il Galeone creazioni orafe
Ascarello
Siena
Osservatorio Astronomico...
SS674
Casone
Castello di Belcaro
Agostoli
Peruzzo
Val di Pugna
Presciano
CONAD
SS715
SP46
SS223
Bucciano
SP136
Taverne D'arbia
Arbia
SP73bis
Costalpino
Cerchiaia
Doglia
Pianigiani Rottami S.r.l
I più votati
Cerreto Selva
Sant'Andrea A Montecchio

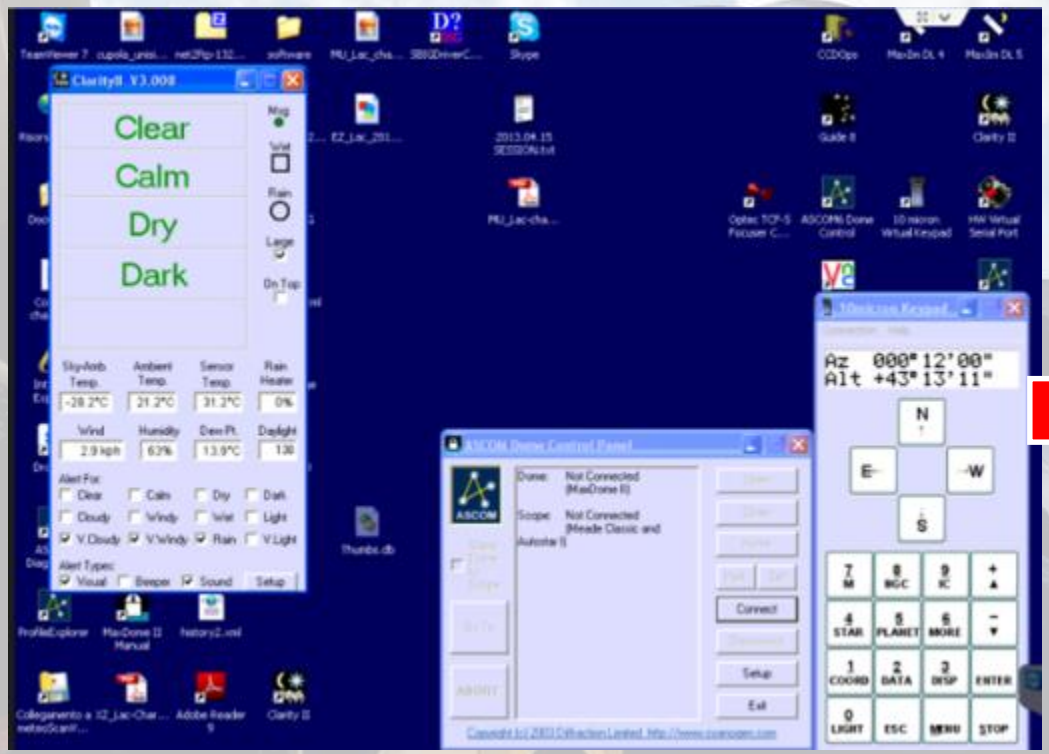

N
W
S

This story began 14 years ago…



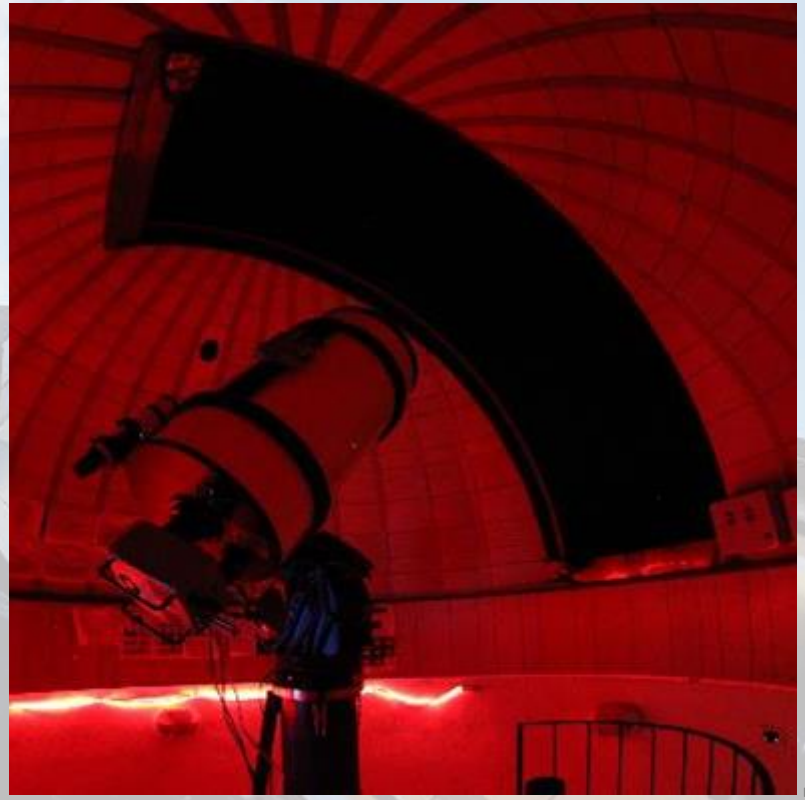
Video: https://youtu.be/hsoO2sE2ALo

2012: the observatory can be managed remotely



What can we do with our instruments?

- 3 meters **dome**
- 30 cm f/5.6 Maksutov-Cassegrain **telescope**
- Sbig STL-6303 **CCD camera**
  (3072 x 2048 9 micron pixels)
- Johnson-Cousins BVRI (+ Clear) **photometric filters**
- Optec TCF-S **focuser**



Photometry

Research fields *(and limits)*

- **Variable stars** *(mag <16)*
- **Asteroids** *(mag <15.5)*
- **Exoplanets** *(mag <13)*
- **Blazars (AGN)** *(mag <17.5)*
- Stellar occultations *(mag <11)*

Variable stars

New Variables Discovered by Data Mining Images Taken During Recent Asteroid Photometric Surveys at the Astronomical Observatory of the University of Siena: Results for the Year 2017

Alessandro Marchini
Astronomical Observatory, DSFTA, University of Siena (K54), Siena, Italy; alessan

Riccardo Papini
Wild Boar Remote Observatory (K49), San Casciano in val di Pesa, Florence, Italy

Fabio Salvaggio
Wild Boar Remote Observatory (K49), Saronno, Italy; Gruppo Astrofili Catanesi, C

Claudio Arena
Private Remote Observatory, Catania, Italy; Gruppo Astrofili Catanesi, Catania, Ita

Davide Agnetti
Osservatorio Aldo Agnetti di Lomazzo, Como, Italy

Mauro Bachini
Giacomo Succi
Osservatorio Astronomico di Tavolaia (A29), Santa Maria a Monte, Pisa, Italy

Massimo Banfi
Osservatorio di Nova Milanese (A25), Nova Milanese, Italy; Osservatorio delle Pre

Received May 1, 2018; revised June 6, 2018; accepted June 16, 2018

Abstract This paper continues the publication of the list of the new variables disco
University of Siena, while observing asteroids for determining their rotational period
are strongly encouraged in order to better characterize these stars, especially those s

Table 2. Main information and results for the new variables discovered.

Star (VSX identifier)	*R.A. (J2000)* *h m s*	*Dec. (J2000)* *° ' "*	*Const.*	*Parallax (mas)*	*CV Mag*	*Period (days)*	*Epoch (HJD–2450000)*	*Type*
UCAC4 555-035787	06 59 09.13	+20 56 51.2	Gem	0.6879 ± 0.0698	15.16–15.70	0.38623 ± 0.00004	7762.6100 ± 0.0002	EW
UCAC4 557-036373	07 01 12.92	+21 17 32.7	Gem	0.4059 ± 0.0633	15.43–15.69	0.39344 ± 0.00001	7762.6150 ± 0.0008	EW
UCAC4 555-036219	07 01 38.40	+20 48 25.0	Gem	0.7917 ± 0.1300	15.97–16.30	0.37451 ± 0.00003	7760.6260 ± 0.0003	EW
GSC 01356-00372	07 02 31.80	+20 48 30.8	Gem	0.5267 ± 0.0392	13.41–13.51	0.081182 ± 0.000004	7759.3714 ± 0.0002	DSCT
GSC 01957-00131	09 17 33.89	+27 41 53.6	Cnc	0.0784 ± 0.0987	13.86–14.09	0.5060 ± 0.0001	7799.3868 ± 0.0002	EB
GSC 05536-00897	13 05 19.16	–09 09 18.9	Vir	0.5310 ± 0.0393	13.92–13.98	0.04562 ± 0.00006	7861.4271 ± 0.0004	DSCT
CMC15 J145002.3-051256	14 50 02.40	–05 12 56.0	Lib	0.4993 ± 0.0833	16.35–16.82	0.366271 ± 0.000004	7865.5445 ± 0.0003	EB
UCAC4 441-061555	15 50 44.36	–01 56 22.5	Ser		15.27–15.58	0.234492 ± 0.000002	7873.5057 ± 0.0004	EW
GSC 05627-00080	16 28 56.49	–08 07 27.1	Oph	0.4737 ± 0.3780	13.60–13.98	0.315999 ± 0.000005	7895.4496 ± 0.0003	EW
GSC 05627-00248	16 29 48.01	–07 45 11.4	Oph	0.5621 ± 0.0315	13.85–14.15	0.525977 ± 0.000004	7912.4069 ± 0.0003	EB
CMC15 J163041.4-080658	16 30 41.49	–08 06 58.9	Oph	0.0573 ± 0.1123	16.22–16.78	0.062443 ± 0.000004	7895.4461 ± 0.0005	HADS
UCAC4 410-066217	16 32 23.19	–08 01 43.3	Oph	1.1583 ± 0.0545	15.03–15.47	0.315450 ± 0.000004	7900.4089 ± 0.0003	EW
UCAC4 460-061118	16 51 31.20	+01 53 25.7	Oph	0.1344 ± 0.0834	16.25–16.60	0.066938 ± 0.000001	7899.5595 ± 0.0004	HADS
CMC15 J172111.9-045046	17 21 11.95	–04 50 46.1	Oph	0.1530 ± 0.1083	15.97–16.45	0.111612 ± 0.000001	7889.4210 ± 0.0004	HADS
UCAC4 428-070068	17 22 31.18	–04 32 53.5	Oph	0.2994 ± 0.0565	14.43–14.74	0.624796 ± 0.000005	7891.5091 ± 0.0004	RRAB
CMC15 J172246.1-043401	17 22 46.20	–04 34 01.1	Oph	0.8155 ± 0.1243	15.83–16.45	0.315587 ± 0.000006	7889.5333 ± 0.0004	EW
UCAC4 370-097050	17 38 28.90	–16 09 01.8	Oph	1.3581 ± 0.0369	14.30–14.80	0.358423 ± 0.000003	7924.4495 ± 0.0002	EW
UCAC4 369-097914	17 39 11.15	–16 16 25.2	Oph	0.7032 ± 0.0263	13.60–14.17	0.870247 ± 0.000006	7922.4514 ± 0.0005	EB
GSC 05117-01301	18 39 47.51	–02 45 05.8	Ser	2.4761 ± 0.0249	13.85–14.55	0.547939 ± 0.000002	7935.3423 ± 0.0001	EA
GSC 05117-00326	18 40 45.36	–02 26 19.5	Ser	0.4171 ± 0.0251	14.41–14.52	0.119096 ± 0.000004	7930.4890 ± 0.0003	DSCT
UCAC4 641-065317	19 06 44.58	+38 10 12.9	Lyr	0.6471 ± 0.0184	13.92–14.61	0.503517 ± 0.000003	7906.5021 ± 0.0002	EW
CMC15 J190719.6+375515	19 07 19.60	+37 55 15.5	Lyr	0.5615 ± 0.0451	16.37–16.92	0.285236 ± 0.000003	7907.4353 ± 0.0002	EW
UCAC4 641-065553	19 08 00.32	+38 01 57.1	Lyr	0.3778 ± 0.0343	15.69–16.24	0.398495 ± 0.000004	7907.5396 ± 0.0003	EW
UCAC4 409-132318	20 38 50.28	–08 22 42.1	Aqr	0.2866 ± 0.0420	15.09–15.20	0.058415 ± 0.000004	7951.4911 ± 0.0003	DSCT

Note: The column "Parallax" is derived from Gaia Data Release 2 data, recently available, and the value is expressed in milli-arcseconds. The column CV Mag is the magnitude range expressed in Clear (unfiltered) band aligned at V band, as explained in Section 2.

Variable stars

«Dal mio salotto ho scoperto una stella»

Sara, studentessa di Fisica, era collegata via web al telescopio di Siena per studiare un asteroide

L'astro

● La stella GSC 5765-

SIENA Nella costellazione dell'acquario, al di là dell'asteroide 9801 1997 FX3, ci sono due stelle che si prendono per mano. «Fanno un girotondo cosmico

«È una studentessa brillantissima, un astro nascente», dicono di lei amici e docenti e quegli elogi, che non nascondono ironie, hanno davvero un

Laureanda Sara Marullo, 23 anni, milanese che vive a Grossetano, si sta laureando in Fisica all'Università di Siena

in remoto il telecopio dell'osservatorio, e ha iniziato a scrutare il cielo.

«Stavo studiando l'asteroide ma la luce di quella stella era aliena, diversa da tutte le altre — racconta —. La luminosità variava continuamente in modo ciclico e questa è una anomalia per un normale astro. Così quella notte ho osservato e fotografato sino all'alba. E ho capito che in realtà erano due le stelle, nascoste da una sorta di girotondo che le celava agli astronomi».

La conferma della scoperta è arrivata il giorno dopo dall'analisi delle fotografie eseguita dal gruppo di ricerca composto dal responsabile dell'osservatorio Alessandro Marchini e dagli astrofili Fabio Salvaggio e Riccardo Papini con la collaborazione della professoressa Carmela Marinelli. Sì, c'era un'altra stella, che gli scienziati chiamano «variabile», a danzare remota in quel tratto di universo. Una scoperta già convalidata e censita dall'International Variable Star Index, il più autorevole database di oggetti astronomici, con una nuova sigla e con il nome della scopritrice.

Lo studio della fisica e dell'astronomia per Sarà è una vera e propria passione. «È così totalizzante da essere diventata anche il mio hobby — spiega —. Ma i sacrifici che ti chiede te le restituisce in attimi di bellezza assoluta. Guardi il cielo e studi lo spazio e il tempo. Osservi le stelle e scienza e poesia si fondono in un mix unico e indescrivibile. C'è tutto lassù, anche estetica ed etica. Perché è proprio vero che il cielo stellato è sopra di noi e la legge morale è dentro di noi».

Marco Gasperetti
mgasperetti@corriere.it

Preliminary Modeling of the Eclipsing Binary Star GSC 05765-01271

Sara Marullo
Astronomical Observatory, DSFTA - University of Siena (K54), via Ron *arullo@student.unisi.it*

Alessandro Marchini
Astronomical Observatory, DSFTA - University of Siena (K54), via Ron

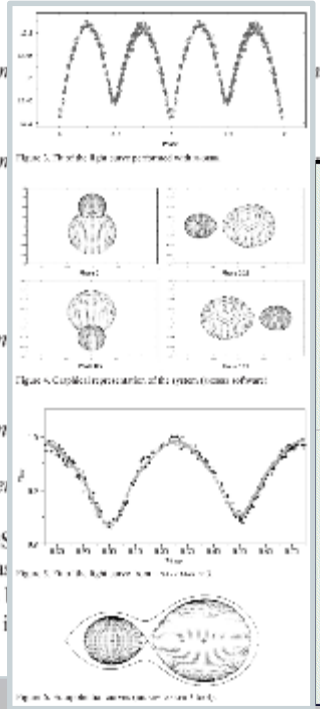
Lorenzo Franco
Balzaretto Observatory (A81), Rome, Italy

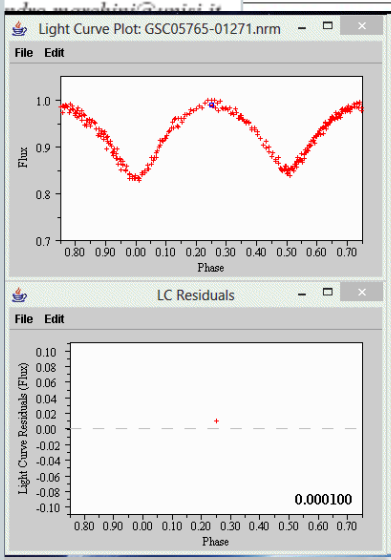
Riccardo Papini
Wild Boar Remote Observatory (K49), via Potente 52, San Casciano in

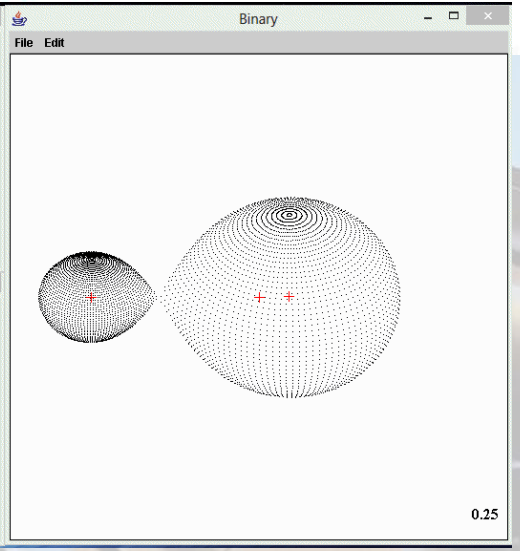
Fabio Salvaggio
Wild Boar Remote Observatory (K49), via Potente 52, San Casciano in

Received October 31, 2017; revised December 9, 2017; accepted Dece

Abstract The authors discovered the eclipsing binary star system GS
model is presented. Lacking spectroscopic radial velocity data, period-ba
physical parameters as masses and radii. The effective temperature has
estimated from a composite spectrum. These parameters were used as i
with BINARY MAKER 3 and PHOEBE software.

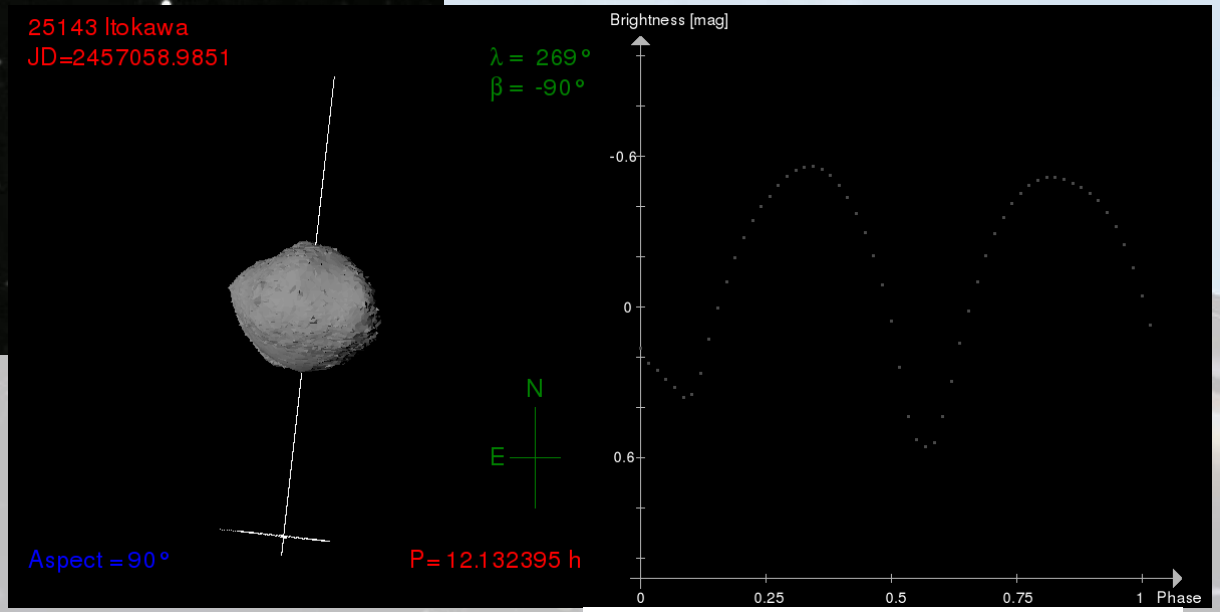






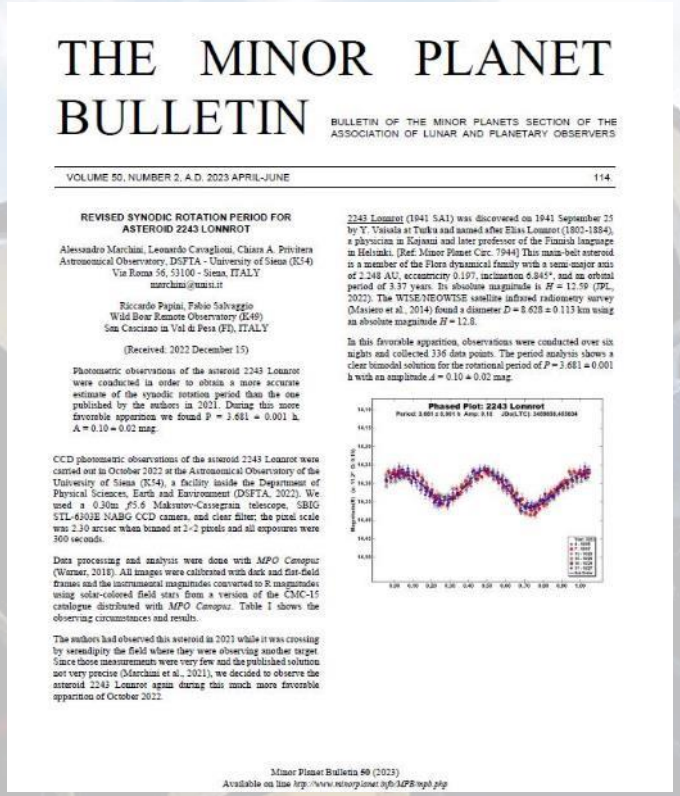
Asteroids – Rotation period determination

Video:
https://youtu.be/u1AGHO9_YIQ



ESA / http://www.gaiagosa.eu/guide

Asteroids – Rotation period determination



THE MINOR PLANET BULLETIN

BULLETIN OF THE MINOR PLANETS SECTION OF THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

VOLUME 50, NUMBER 2, A.D. 2023 APRIL-JUNE 114

REVISED SYNODIC ROTATION PERIOD FOR ASTEROID 2243 LONNROT

Alessandro Marchini, Leonardo Cavaglioni, Chiara A. Privitera
Astronomical Observatory, DSFTA - University of Siena (K54)
Via Roma 56, 53100 - Siena, ITALY
marchini@unisi.it

Riccardo Papini, Fabio Salvaggio
Wild Boar Remote Observatory (K49)
San Casciano in Val di Pesa (FI), ITALY

(Received: 2022 December 15)

Photometric observations of the asteroid 2243 Lonnrot were conducted in order to obtain a more accurate estimate of the synodic rotation period than the one published by the authors in 2021. During this more favorable apparition we found $P = 3.681 \pm 0.001$ h, $A = 0.10 \pm 0.02$ mag.

CCD photometric observations of the asteroid 2243 Lonnrot were carried out in October 2022 at the Astronomical Observatory of the University of Siena (K54), a facility inside the Department of Physical Sciences, Earth and Environment (DSFTA, 2022). We used a 0.30m f/5.6 Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera, and clear filter; the pixel scale was 2.30 arcsec when binned at 2×2 pixels and all exposures were 300 seconds.

Data processing and analysis were done with *MPO Canopus* (Warner, 2018). All images were calibrated with dark and flat-field frames and the instrumental magnitudes converted to R magnitudes using solar-colored field stars from a version of the CMC-15 catalogue distributed with *MPO Canopus*. Table I shows the observing circumstances and results.

The authors had observed this asteroid in 2021 while it was crossing by serendipity the field where they were observing another target. Since those measurements were very few and the published solution not very precise (Marchini et al., 2021), we decided to observe the asteroid 2243 Lonnrot again during this much more favorable apparition of October 2022.

2243 Lonnrot (1941 SA1) was discovered on 1941 September 25 by Y. Vaisala at Turku and named after Elias Lonnrot (1802-1884), a physician in Kajaani and later professor of the Finnish language in Helsinki. [Ref: Minor Planet Circ. 7944] This main-belt asteroid is a member of the Flora dynamical family with a semi-major axis of 2.248 AU, eccentricity 0.197, inclination 6.845°, and an orbital period of 3.37 years. Its absolute magnitude is $H = 12.59$ (JPL, 2022). The WISE/NEOWISE satellite infrared radiometry survey (Masiero et al., 2014) found a diameter $D = 8.628 \pm 0.113$ km using an absolute magnitude $H = 12.8$.

In this favorable apparition, observations were conducted over six nights and collected 336 data points. The period analysis shows a clear bimodal solution for the rotational period of $P = 3.681 \pm 0.001$ h with an amplitude $A = 0.10 \pm 0.02$ mag.

Minor Planet Bulletin 50 (2023)
Available on line http://www.minorplanet.info/MPB/mpb.php

ROTATION PERIOD DETERMINATION FOR ASTEROID 12919 TOMJOHNSON

Alessandro Marchini, Riccardo Papini
Astronomical Observatory, DSFTA - University of Siena (K54)
Via Roma 56, 53100 - Siena, ITALY
marchini@unisi.it

(Received: 2022 October 14)

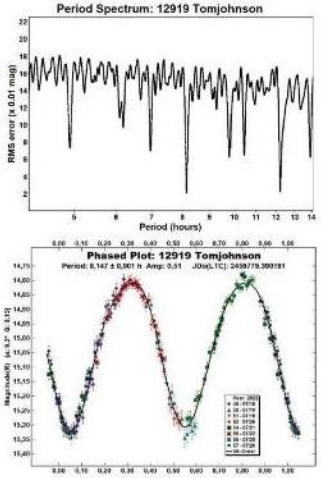
Photometric observations of the main-belt asteroid 12919 Tomjohnson were conducted in order to determine its synodic rotation period. We found $P = 8.147 \pm 0.001$ h, $A = 0.51 \pm 0.03$ mag.

CCD photometric observations of the main-belt asteroid 12919 Tomjohnson were carried out in July 2022 at the Astronomical Observatory of the University of Siena (K54), a facility inside the Department of Physical Sciences, Earth and Environment (DSFTA, 2022). We used a 0.30-m f/5.6 Maksutov-Cassegrain telescope, SBIG STL-6303E NABG CCD camera, and clear filter; the pixel scale was 2.30 arcsec when binned at 2×2 pixels and all exposures were 300 seconds.

Data processing and analysis were done with *MPO Canopus* (Warner, 2018). All images were calibrated with dark and flat-field frames and the instrumental magnitudes converted to R magnitudes using solar-colored field stars from a version of the CMC-15 catalogue distributed with *MPO Canopus*. Table I shows the observing circumstances and results.

A search through the asteroid lightcurve database (LCDB, Warner et al., 2009) indicates that our result may be the first reported lightcurve observations and results for this asteroid.

12919 Tomjohnson (1998 VD6) was discovered on 1998 November 11 at Catalina by the Catalina Sky Survey and named in honor of Thomas J. Johnson who developed a technique for creating Schmidt telescope correctors that allowed the mass production of Schmidt-Cassegrain telescopes. It is an inner main-belt asteroid with a semi-major axis of 2.274 AU, eccentricity 0.218, inclination 6.368°, and an orbital period of 3.43 years. Its absolute magnitude is $H = 14.02$ (JPL, 2022). The WISE/NEOWISE satellite infrared radiometry survey (Masiero et al., 2011) found a diameter $D = 4.882 \pm 0.468$ km using an absolute magnitude $H = 13.7$.



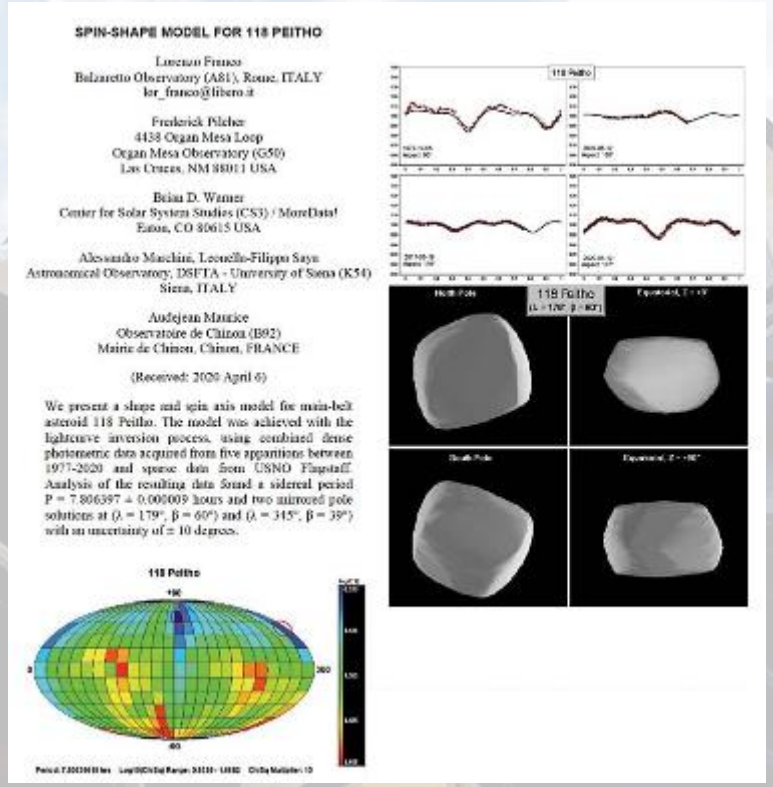
Observations were conducted over four nights and collected 191 data points. The period analysis shows a bimodal solution for the rotational period of $P = 8.147 \pm 0.001$ h with an amplitude $A = 0.51 \pm 0.03$ mag. This target was observed within the Photometric Survey for Asynchronous Binary Asteroids under the leadership of Petr Pravec from Ondrejov Observatory, Czech Republic (Pravec et al., 2006; Pravec, 2022web) and their independent analysis confirmed our results.

Number	Name	2022/mm/dd	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
12919	Tomjohnson	07/19-07/26	8.2,6.7	306	7	8.147	0.001	0.51	0.03	MBI

Table I. Observing circumstances and results. The phase angle is given for the first and last date. If preceded by an asterisk, the phase angle reached an extrema during the period. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude/latitude at mid-date range (see Harris et al., 1984). Grp is the asteroid family/group (Warner et al., 2009).

Over 300 asteroids observed since 2014

Asteroids – 3D modeling from photometry



SPIN-SHAPE MODEL FOR 118 PEITHO

Lorenzo Franco
Balzaretto Observatory (A81), Rome, ITALY
lor_franco@libero.it

Frederick Pilcher
4438 Organ Mesa Loop
Organ Mesa Observatory (G50)
Las Cruces, NM 88011 USA

Brian D. Warner
Center for Solar System Studies (CS3) / MoreData!
Eaton, CO 80615 USA

Alessandro Marchini, Lucrello-Filippo Sayn
Astronomical Observatory, DSFTA - University of Siena (K54)
Siena, ITALY

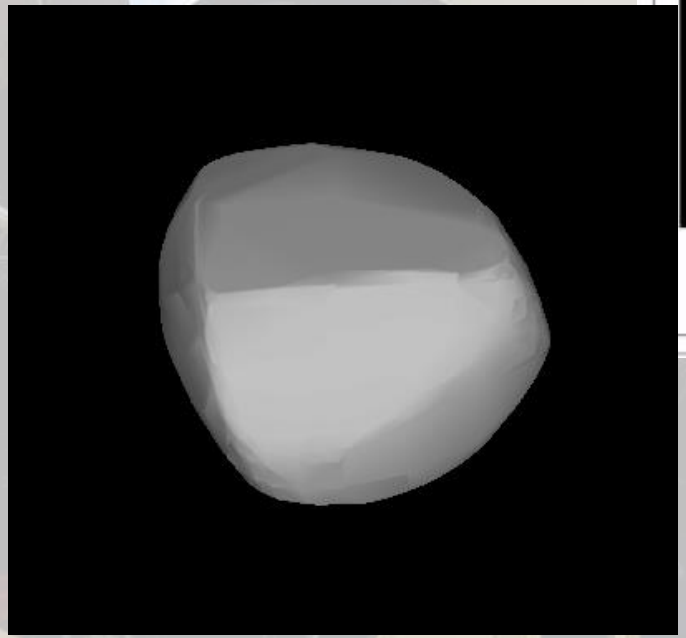
Audejean Maurice
Observatoire de Chinon (B92)
Mairie de Chinon, Chinon, FRANCE

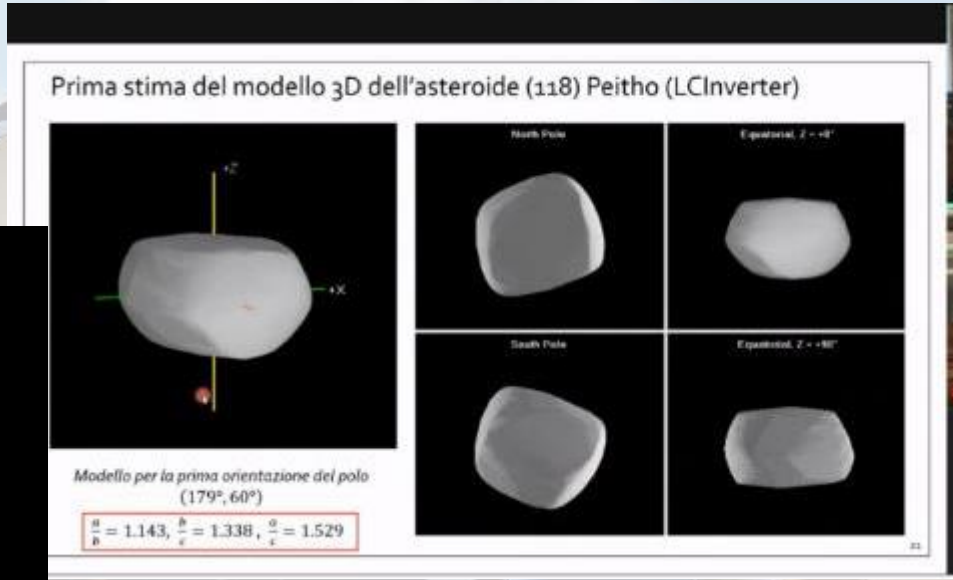
(Received: 2020 April 6)

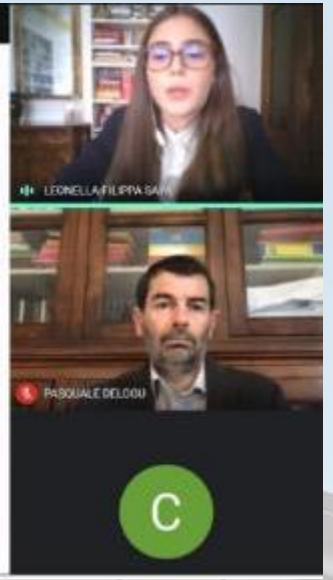
We present a shape and spin axis model for main-belt asteroid 118 Peitho. The model was achieved with the lightcurve inversion process, using combined dense photometric data acquired from five apparitions between 1977-2020 and sparse data from USNO Flagstaff. Analysis of the resulting data found a sidereal period P = 7.806397 ± 0.000009 hours and two mirrored pole solutions at (λ = 179°, β = 60°) and (λ = 345°, β = 39°) with an uncertainty of ± 10 degrees.

Light Curve Inversion method

2020: Leonella discusses *(online)* her thesis







Asteroids – Binary systems

IAU Central Bureau for Astronomical Telegrams

Electronic Telegram No. 4243

Central Bureau for Astronomical Telegrams
Mailing address: Hoffman Lab 209; Harvard University;
20 Oxford St.; Cambridge, MA 02138; U.S.A.
e-mail: cbatiau@eps.harvard.edu (alternate cbat@iau.org)
URL http://www.cbat.eps.harvard.edu/index.html
Prepared using the Tamkin Foundation Computer Network

(2242) BALATON

A. Marchini, F. Salvaggio, and R. Papini, Astronomical Observatory, Dipartimento di Scienze Fisiche della Terra e dell'Ambiente, University of Siena; P. Pravec, Ondrejov Observatory; D. Klinglesmith, Magdalena Ridge Observatory; D. Pray, Sugarloaf Mountain Observatory, South Deerfield, MA, U.S.A.; P. Bacci, Astronomical Observatory of San Marcello Pistoiese, Italy; L. Franco, Balzaretto Observatory, Rome, Italy; and A. Carbognani, Astronomical Observatory of the Aosta Valley Autonomous Region, Italy, report that photometric observations taken with a 0.30-m telescope at the Astronomical Observatory of the University of Siena, a 0.36-m telescope at the Etscorn Campus Observatory (Socorro, NM, U.S.A.), a 0.50-m telescope at the Sugarloaf Mountain Observatory, and a 0.60-m telescope at the San Marcello Pistoiese Observatory during 2015 Dec. 27-2016 Jan. 16 reveal that minor planet (2242) is a binary system with an orbital period of 12.96 +/- 0.01 hr. The primary shows a period of 2.79792 +/- 0.00009 hr and has a lightcurve amplitude of 0.18 mag at solar phases 5-16 degrees, suggesting a nearly spheroidal shape. Mutual eclipse/occultation events that are 0.03- to 0.08-magnitude deep indicate a lower limit on the secondary-to-primary mean-diameter ratio of 0.25.

NOTE: These 'Central Bureau Electronic Telegrams' are sometimes superseded by text appearing later in the printed IAU Circulars.

2016 January 23 (CBET 4243) Daniel W. E. Green

Minor Planet Bulletin 43 (2016)

THE BINARY NATURE OF THE ASTEROID 2242 BALATON

Alessandro Marchini
Astronomical Observatory, DSFTA - University of Siena (K54)
Via Roma 56, 53100 - Siena, ITALY
alessandro.marchini@unisi.it

Paolo Bacci
Osservatorio Astronomico San Marcello Pistoiese (104)
San Marcello Pistoiese, Pistoia, ITALY

Albino Carbognani
Astronomical Observatory of the Autonomous Region of the Aosta Valley (OAVdA)
Lignan 39, 11020 Nus (Aosta), ITALY

Lorenzo Franco
Balzaretto Observatory (A81), Rome, ITALY

Daniel A. Klinglesmith III
New Mexico Tech, Socorro, NM USA

Riccardo Papini
Carpione Observatory (K49)
Spedaletto, Florence, ITALY

Petr Pravec
Astronomical Institute
Academy of Sciences of the Czech Republic
Fričova 1, CZ-25165 Ondřejov, CZECH REPUBLIC

Donald P. Pray
Sugarloaf Mountain Observatory
South Deerfield, MA USA

Fabio Salvaggio
21047 - Saronno, ITALY

(Received: 2016 Jul 15)

Initial observations of 2242 Balaton indicated a rotation period of about 2.8 hours with some attenuation events. Further observations and analysis showed that 2242 is a binary asteroid with a primary period of 2.7979 ± 0.0001 h and amplitude of 0.18 mag; the orbital period of the secondary is 12.96 ± 0.01 h. Mutual events that are 0.03 to 0.08 magnitude deep indicate a lower limit on the secondary-to-primary mean-diameter ratio of 0.25. From sparse photometric data we also derived $H = 13.31 \pm 0.05$, $G = 0.22 \pm 0.04$.

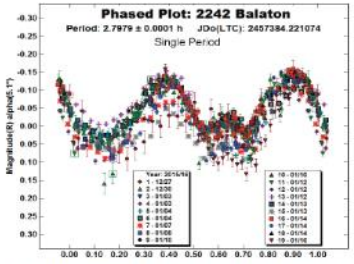


Figure 2. The single-period solution using data from 19 sessions. Note that some sessions show attenuation events in the lightcurve.

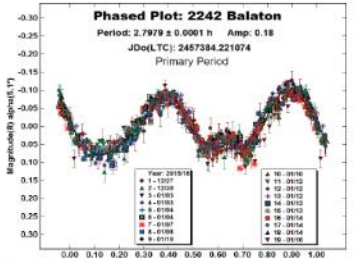
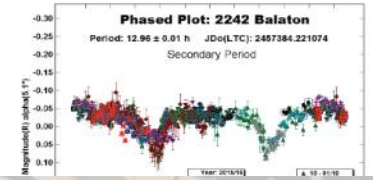


Figure 3. Using the dual-period search within MPO Canopus after subtracting out the secondary period, we obtain the primary period.



21 binary asteroids discovered

International collaboration: *BinAst*

Photometric Survey for Asynchronous Binary Asteroids

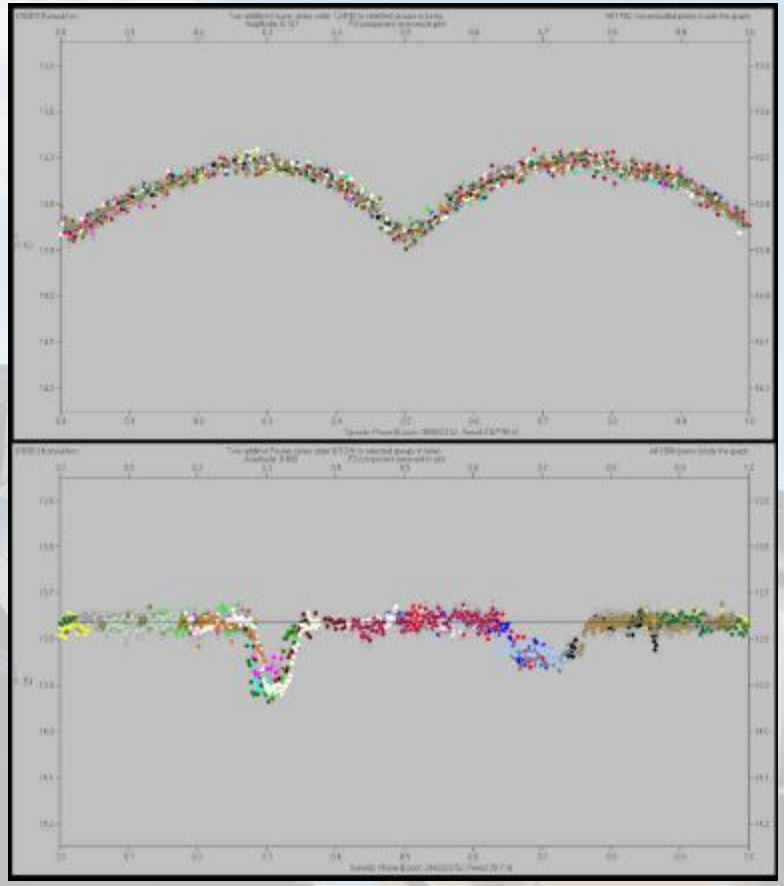
The goal of the survey is to discover asynchronous binary asteroids among small NEAs, MCs, and inner MBAs, and to do it in a controlled way that allows to simulate selection effects and biases in the obtained sample. For that, we use the photometric technique, see our paper ***Photometric Survey of Binary Near-Earth Asteroids*** that has appeared in Icarus 181 (2006) 63-93, its reprint is available here; see also newer reports and presentations mentioned here. Another paper by Pravec, ***Photometric Survey of Asynchronous Binary Asteroids*** describing the strategy of our Survey has been published in Proceedings of the Symposium on Telescope Science (The 24th Annual Conference of the Society for Astronomical Science), B. D. Warner, D. Mais, D. A. Kenyon, J. Foote (Eds.), the reprint of the paper is available here (0.4 MB). A paper by Pravec and Harris, ***Binary Asteroid Population. 1. Angular Momentum Content***, where data from this Survey were used, has appared in Icarus 190 (2007) 250-259, its reprint is available here. Several more papers with results from the Survey have appeared since then, see them linked, e.g., here.

People and stations taking part in the project coordinate their work through email, using their own e-group. We believe, however, that some basic information is useful to be presented also in a public web page, so we set up this page and provide useful information under links mentioned in following.

- Survey strategy
- People and Stations participating in the Survey
- FAQs
- Summary pages
- Additional links
- Supporting Grant Agencies and other supporting subjects

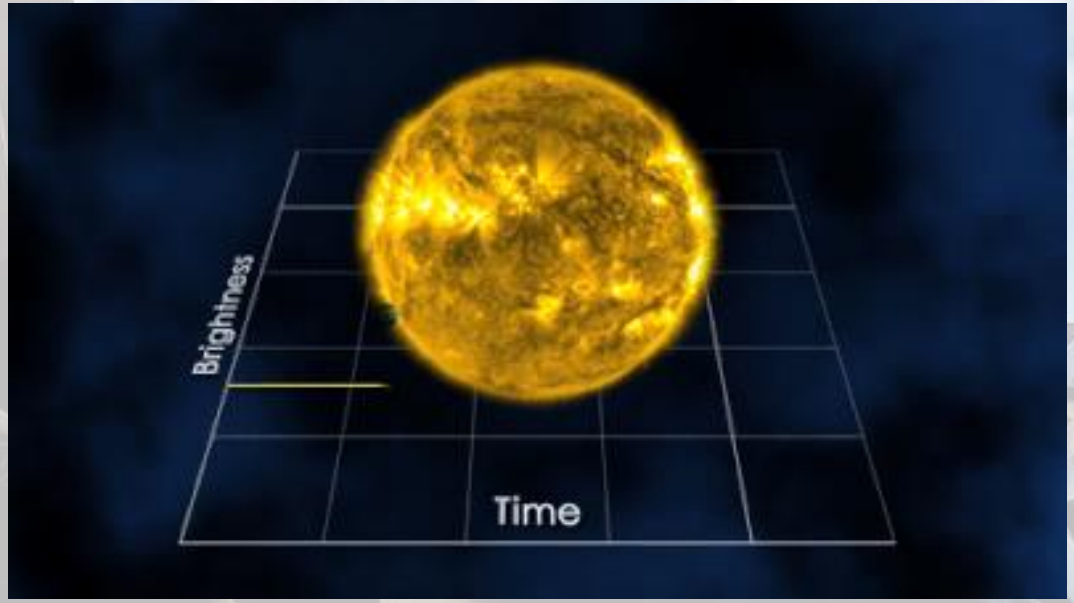
The list of asteroids targeted within the Photometric Survey for Asynchronous Binary Asteroids is given in following. Each item gives a status of the object to a given date, observatories that worked it within the Survey, and links to www pages with results summaries and/or publications.

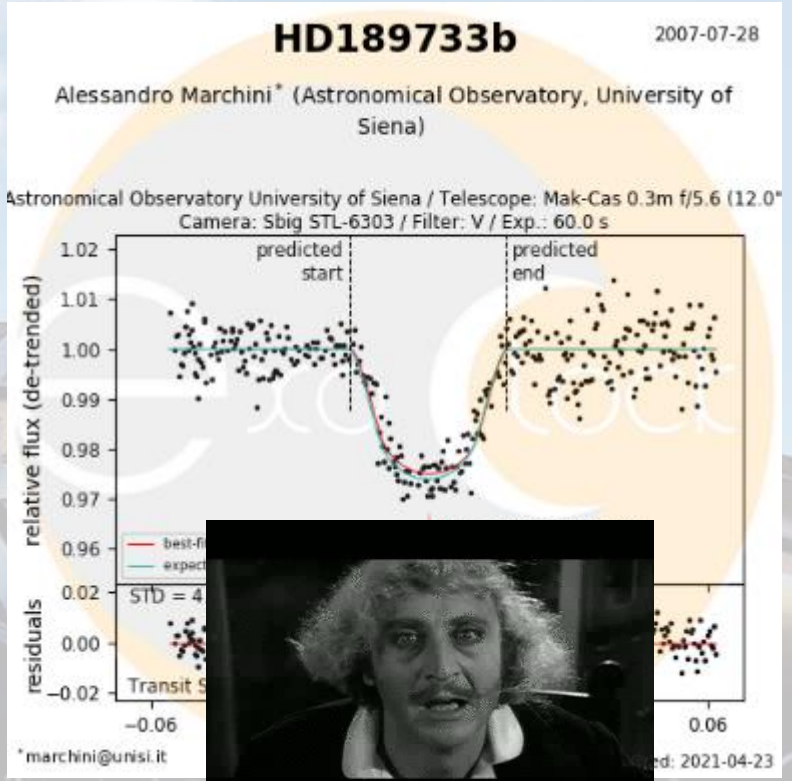
2023 11 17 -- **(7355) Bottke** : BINARY, discovery apparition finished
Sopot, Sugarloaf Montain, Blue Mountains
CBET 5319
2013 11 09 -- **(7355) Bottke** : Done



Asteroid (18301) Konyukhov
CBET 5320, 2023 November 27

Exoplanets


Brightness
Time


HD189733b
2007-07-28
Alessandro Marchini* (Astronomical Observatory, University of Siena)
Astronomical Observatory University of Siena / Telescope: Mak-Cas 0.3m f/5.6 (12.0"
Camera: Sbig STL-6303 / Filter: V / Exp.: 60.0 s
predicted start
predicted end
relative flux (de-trended)
1.02
1.01
1.00
0.99
0.98
0.97
0.96
residuals
0.02
0.00
−0.02
−0.06
0.06
*marchini@unisi.it

Exoplanets: KPS-1b (2018) and GPX-1b (2021)

Publications of the Astronomical Society of the Pacific, 130:074401 (10pp), 2018 July
https://doi.org/10.1088/1538-3873/aabde2

KPS-1b: The First Transiting Exoplanet Discovered Using an Amateur Astronomer's Wide-field CCD Data

Artem Burdanov[1], Paul Benni[2], Eugene Sokov[3,4], Vadim Krushinsky[5], Alexander Popov[5], Laetitia Delrez[6], Michael Gillon[1], Guillaume Hébrard[7,8], Magali Deleuil[9], Paul A. Wilson[7,10], Olivier Demangeon[11], Özgür Baştürk[12], Erika Pakštiene[13], Iraida Sokova[3], Sergei A. Rusov[3], Vladimir V. Dyachenko[4], Denis A. Rastegaev[4], Anatoliy Beskakotov[4], Alessandro Marchini[14], Marc Bretton[15], Stan Shadick[16], and Kirill Ivanov[17]

[1] Space sciences, Technologies and Astrophysics Research (STAR) Institute, Université de Liège, Allée du 6 Août 17, B-4000 Liège, Belgium
artem.burdanov@uliege.be
[2] Acton Sky Portal (Private Observatory), Acton, MA, USA
[3] Central Astronomical Observatory at Pulkovo of Russian Academy of Sciences, Pulkovskoje shosse d. 65, St. Petersburg, 196140, Russia
[4] Special Astrophysical Observatory, Russian Academy of Sciences, Nizhnij Arkhyz, 369167, Russia
[5] Ural Federal University, ul. Mira d. 19, Yekaterinburg, 620002, Russia
[6] Astrophysics Group, Cavendish Laboratory, J.J. Thomson Avenue, Cambridge CB3 0HE, UK
[7] Institut d'Astrophysique de Paris, UMR 7095 CNRS, Université Pierre & Marie Curie, 98bis Boulevard Arago, F-75014 Paris, France
[8] Observatoire de Haute-Provence, Université d'Aix-Marseille & CNRS, F-04870 Saint Michel l' Observatoire, France
[9] Aix Marseille Université, CNRS, LAM (Laboratoire d'Astrophysique de Marseille) UMR 7326, F-13388 Marseille, France
[10] Leiden Observatory, Leidenbus 9513, 2300 RA Leiden, The Netherlands
[11] Instituto de Astrofísica e Ciências do Espaço, Universidade do Porto, CAUP, Rua das Estrelas, PT4150-762 Porto, Portugal
[12] Ankara University, Faculty of Science, Department of Astronomy and Space Science, TR-06100 Tandogan, Ankara, Turkey
[13] Institute of Theoretical Physics and Astronomy, Vilnius University, Saulėtekio av. 3, Vilnius, LT-10257, Lithuania
[14] Astronomical Observatory—DSFTA, University of Siena, Via Roma 56, I-53100 Siena, Italy
[15] Baronnies Provençales Observatory, Hautes Alpes—Parc Naturel Régional des Baronnies Provençales, F-05150 Moydans, France
[16] Physics and Engineering Physics Department, University of Saskatchewan, Saskatoon, SK, S7N 5E2, Canada
[17] Irkutsk State University, ul. Karla Marxa d. 1, Irkutsk, 664003, Russia
Received 2017 December 21; accepted 2018 April 11; published 2018 May 16

Abstract

We report the discovery of the transiting hot Jupiter KPS-1b. This exoplanet orbits a $V = 13.0$ K1-type main-sequence star every 1.7 days, has a mass of $1.090^{+0.086}_{-0.087}\ M_{\rm Jup}$ and a radius of $1.03^{+0.13}_{-0.12}\ R_{\rm Jup}$. The discovery was made by the prototype Kourovka Planet Search (KPS) project, which used wide-field CCD data gathered by an amateur astronomer using readily available and relatively affordable equipment. Here we describe the equipment and observing technique used for the discovery of KPS-1b, its characterization with spectroscopic observations by the SOPHIE spectrograph and with high-precision photometry obtained with 1 m class telescopes. We also outline the KPS project evolution into the Galactic Plane eXoplanet survey. The discovery of KPS-1b represents a new major step of the contribution of amateur astronomers to the burgeoning field of exoplanetology.

Key words: methods: data analysis – planets and satellites: detection – planets and satellites: gaseous planets – planets and satellites: individual (KPS-1b) – stars: individual (KPS-1)

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY
MNRAS **505**, 4956–4967 (2021)
Advance Access publication 2021 May 31
https://doi.org/10.1093/mnras/stab1567

Discovery of a young low-mass brown dwarf transiting a fast-rotating F-type star by the Galactic Plane eXoplanet (GPX) survey

P. Benni[1★], A. Y. Burdanov[2,3★], V. V. Krushinsky[4], A. Bonfanti[5,6], G. Hébrard[7,8], J. M. Almenara[9], S. Dalal[7], O. D. S. Demangeon[10], M. Tsantaki[11], J. Pepper[12], K. G. Stassun[13], A. Vanderburg[14*], A. Belinski[15], F. Kashaev[16], K. Barkaoui[17,18], T. Kim[19], W. Kang[19], K. Antonyuk[20], V. V. Dyachenko[21], D. A. Rastegaev[21], A. Beskakotov[21,22], A. A. Mitrofanova[21], F. J. Pozuelos[6,17], E. D. Kuznetsov[23], A. Popov[23], F. Kiefer[7], P. A. Wilson[24,25], G. Ricker[26], R. Vanderspek[26], D. W. Latham[27], S. Seager[2,26,28], J. M. Jenkins[29], E. Sokov[22,30], I. Sokova[22,30], A. Marchini[31], R. Papini[32], F. Salvaggio[32], M. Banfi[32], Ö. Baştürk[33], Ş. Torun[33], S. Yalçınkaya[33], K. Ivanov[34], G. Valyavin[20,21,22], E. Jehin[6], M. Gillon[17], E. Pakštienė[35], V.-P. Hentunen[36], S. Shadick[37], M. Bretton[38], A. Wünsche[38], J. Garlitz[39], Y. Jongen[40], D. Molina[41], E. Girardin[42], F. Grau Horta[43], R. Naves[44], Z. Benkhaldoun[18], M. D. Joner[45], M. Spencer[45], A. Bieryla[27], D. J. Stevens[46,47†], E. L. N. Jensen[48], K. A. Collins[27], D. Charbonneau[27], E. V. Quintana[49], S. E. Mullally[50] and C. E. Henze[29]

Affiliations are listed at the end of the paper

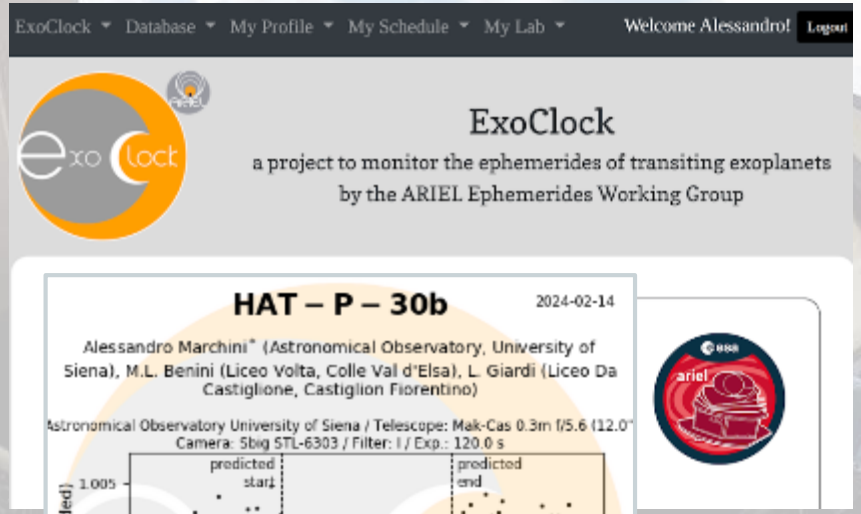
Accepted 2021 May 25. Received 2021 May 25; in original form 2020 July 4

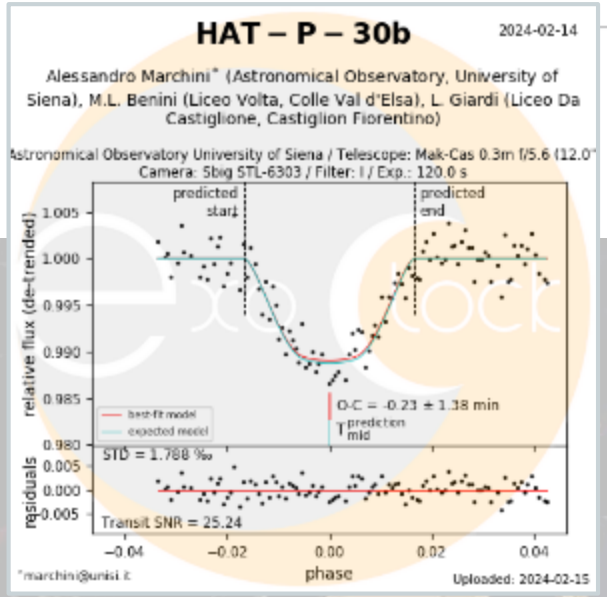
ABSTRACT

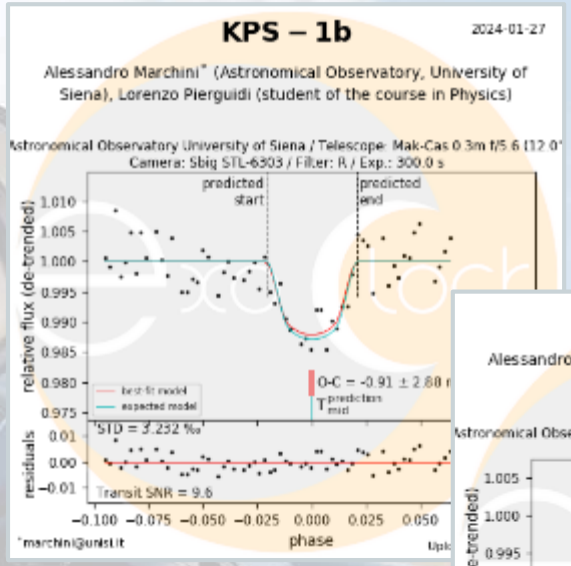
We announce the discovery of GPX-1 b, a transiting brown dwarf with a mass of $19.7 \pm 1.6\ M_{\rm Jup}$ and a radius of $1.47 \pm 0.10\ R_{\rm Jup}$, the first substellar object discovered by the Galactic Plane eXoplanet (GPX) survey. The brown dwarf transits a moderately bright ($V = 12.3$ mag) fast-rotating F-type star with a projected rotational velocity $v \sin i_\star = 40 \pm 10$ km s^{-1}. We use the isochrone placement algorithm to characterize the host star, which has effective temperature 7000 ± 200 K, mass $1.68 \pm 0.10\ M_\odot$, radius $1.56 \pm 0.10\ R_\odot$, and approximate age $0.27^{+0.09}_{-0.15}$ Gyr. GPX-1 b has an orbital period of ~1.75 d and a transit depth of 0.90 ± 0.03 per cent. We describe the GPX transit detection observations, subsequent photometric and speckle-interferometric follow-up observations, and SOPHIE spectroscopic measurements, which allowed us to establish the presence of a substellar object around the host star. GPX-1 was observed at 30-min integrations by *TESS* in Sector 18, but the data are affected by blending with a 3.4 mag brighter star 42 arcsec away. GPX-1 b is one of about two dozen transiting brown dwarfs known to date, with a mass close to the theoretical brown dwarf/gas giant planet mass transition boundary. Since GPX-1 is a moderately bright and fast-rotating star, it can be followed-up by the means of the Doppler tomography.

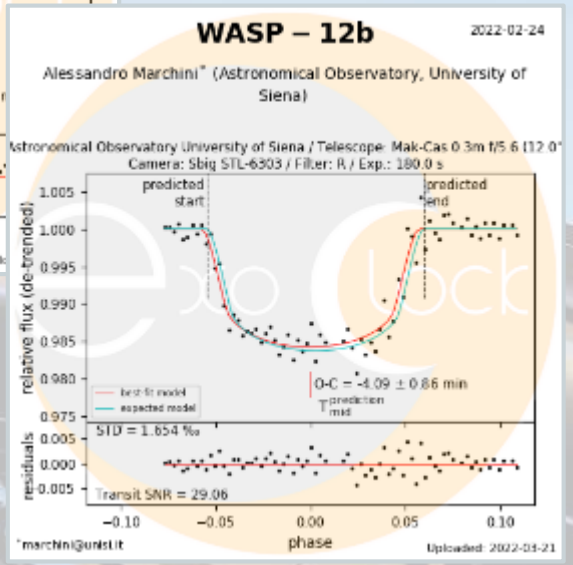
2 exoplanets discovered

International collaboration: *ExoClock*





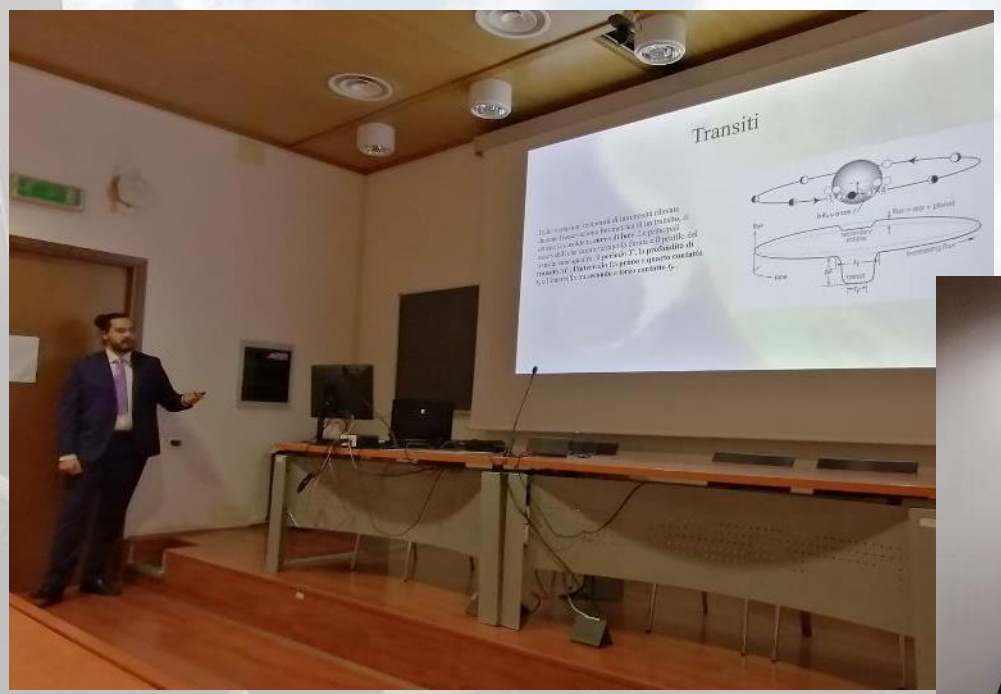




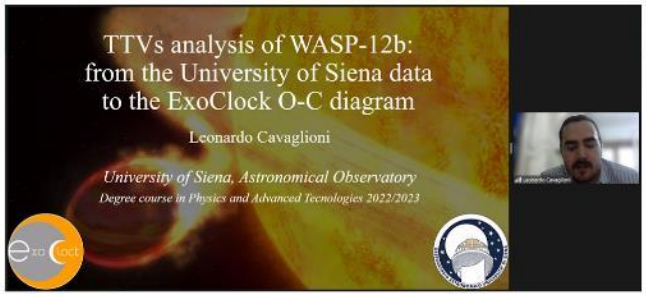
91 observations in the ExoClock database

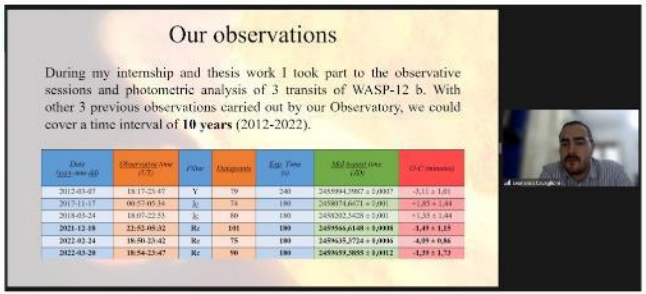
www.exoclock.space

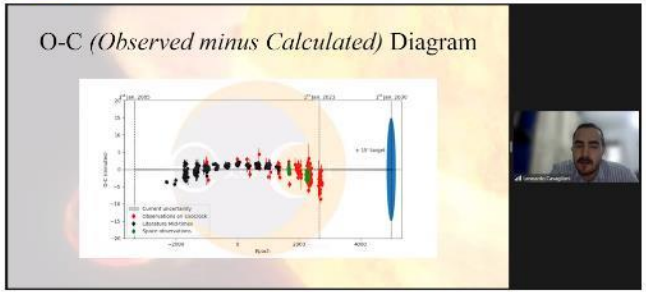
2023: Leonardo discusses his thesis

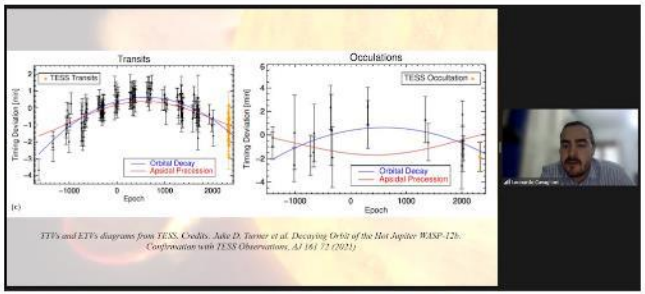


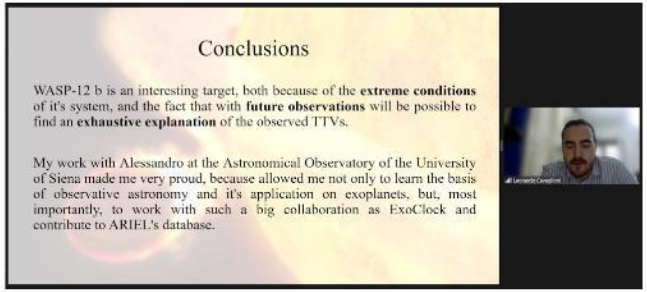
2023: Leonardo presents his work at the *ExoClock meeting*

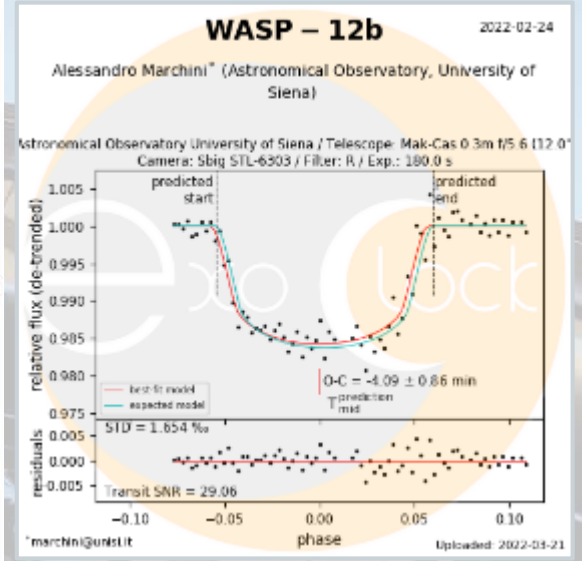




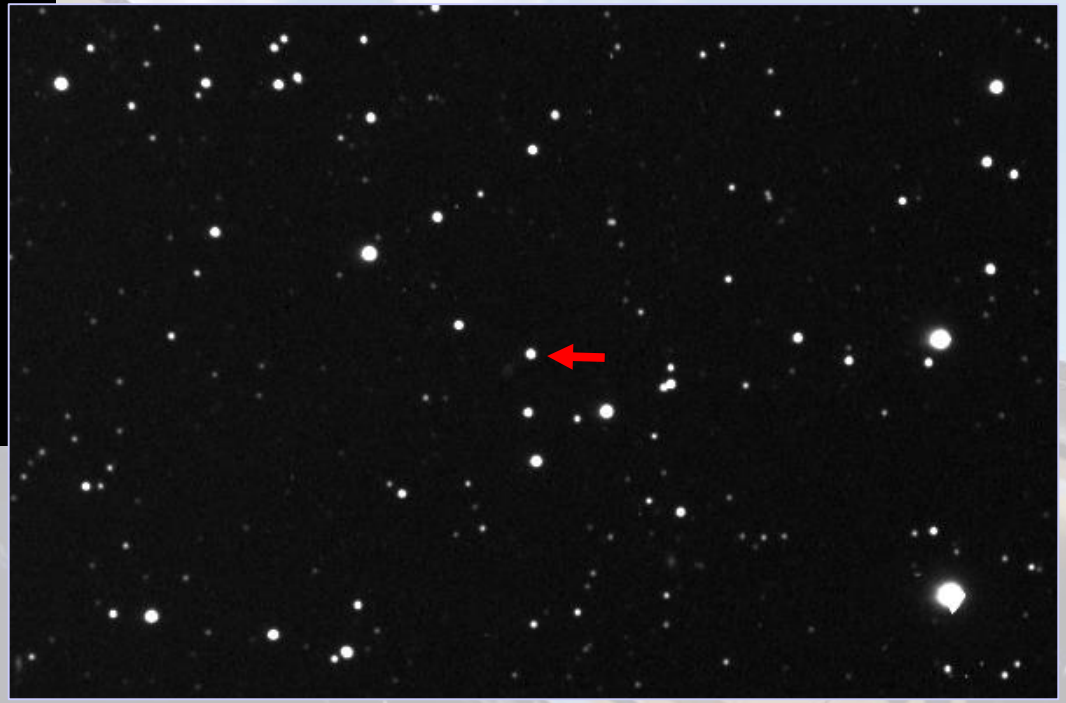




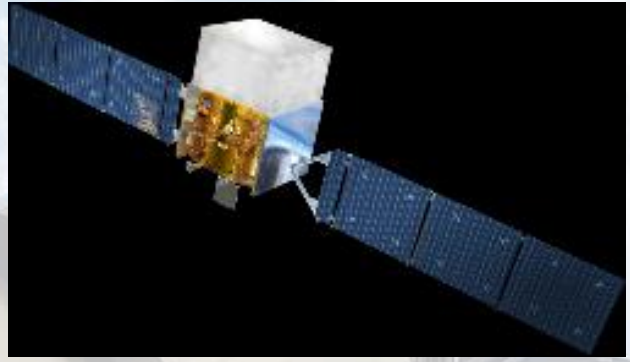




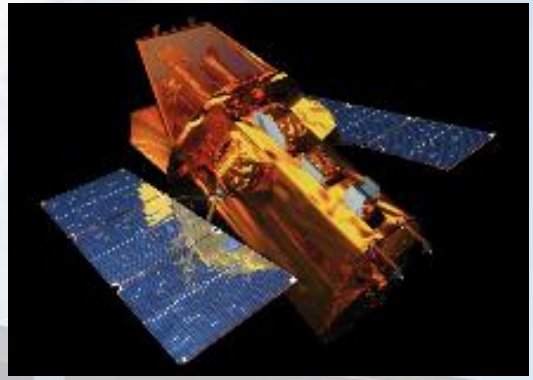
Blazars: the most distant (and powerful) observable objects



Blazars: eyes for the high energies



FERMI (X)



SWIFT (Gamma)

MAGIC (Gamma)

CTA (Gamma)

Blazars: SED *(Spectral Energy Distribution)*

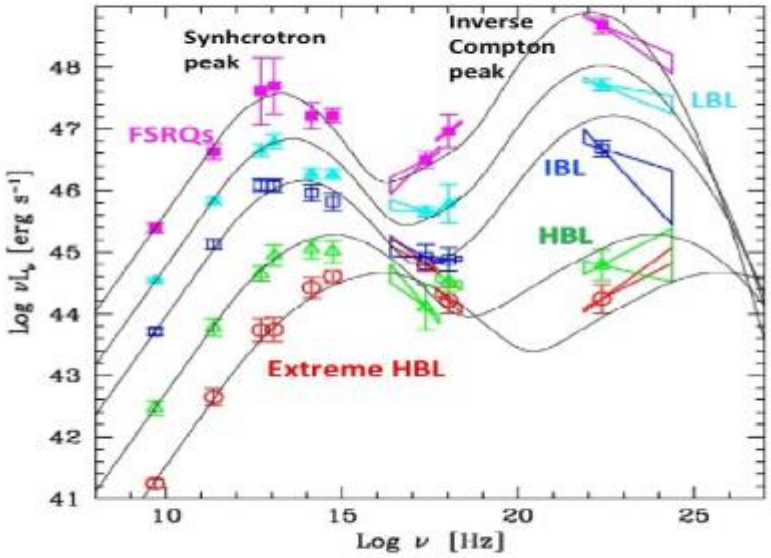


Fig. 2 Overall spectral energy distributions of blazars. Note the differences of the relative intensities and frequencies of the two emission peaks for various types of objects (see text). This behavior is referred to as blazar sequence (from Fossati et al., 1998).

Blazars: our contribution to the *Distribution*

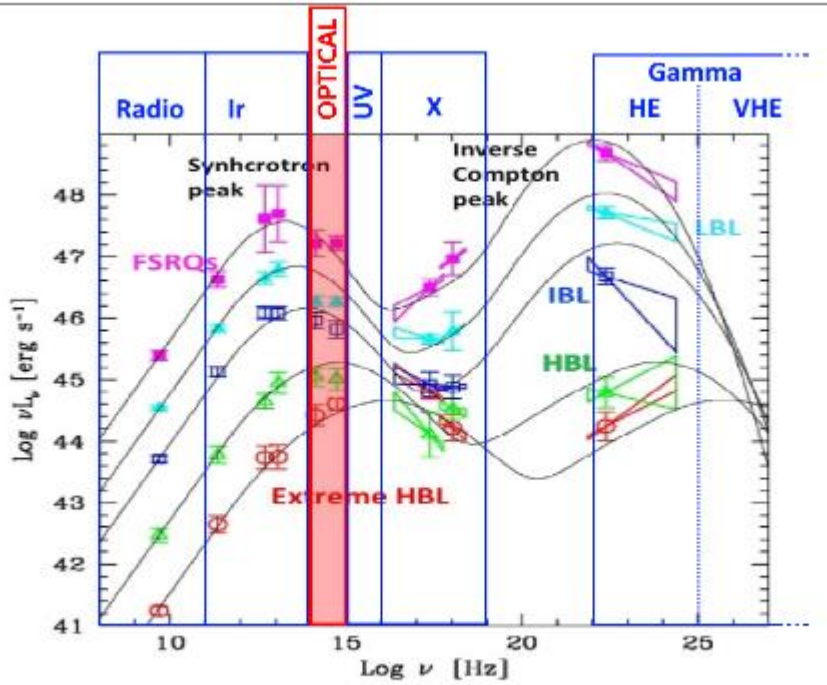


Fig. 2 Overall spectral energy distributions of blazars. Note the differences of the relative intensities and frequencies of the two emission peaks for various types of objects (see text). This behavior is referred to as blazar sequence (from Fossati et al., 1998).

International collaboration: *WEBT*

WHOLE EARTH
BLAZAR TELESCOPE

- Introduction
- Target List
- Ongoing Projects
- Members
- Archive
- Publications

Highlights

S.G. Jorstad, A.P. Marscher, C.M. Raiteri, M. Villata, Z.R. Weaver et al.
2022, Nature 609, 265

Article

Rapid quasi-periodic oscillations in the relativistic jet of BL Lacertae

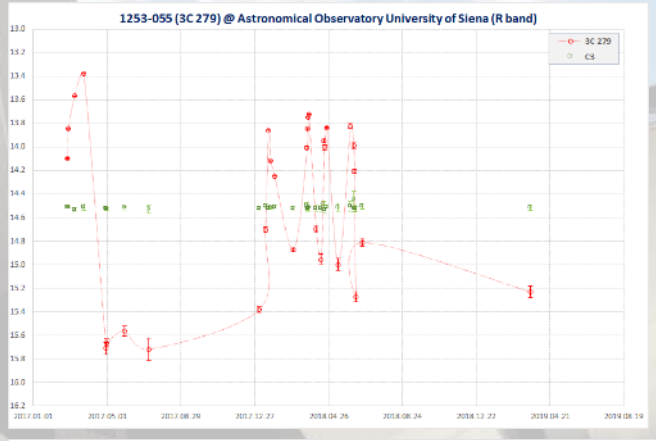
https://doi.org/10.1038/s41586-022-05038-9

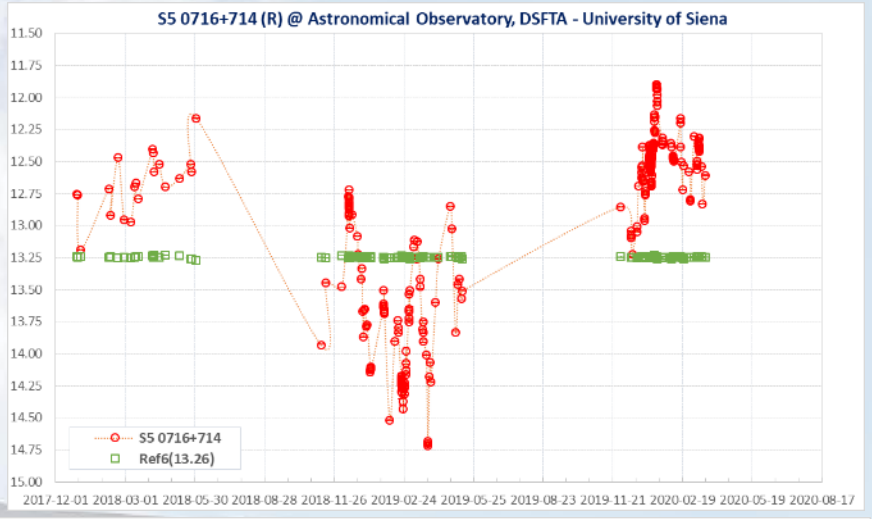
Received: 29 January 2022

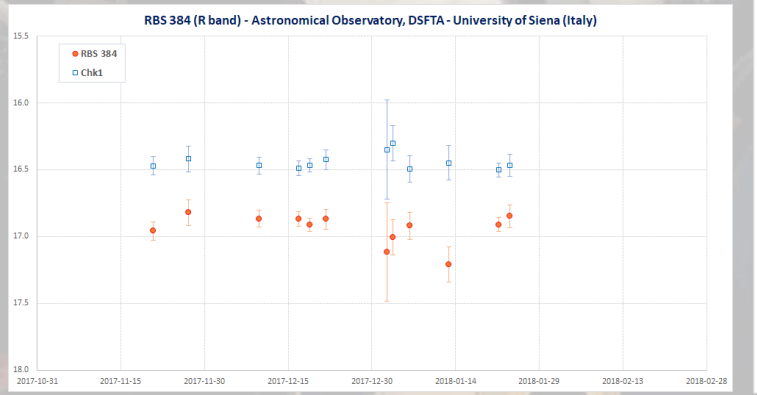
S. G. Jorstad[1,2✉], A. P. Marscher[1], C. M. Raiteri[2], M. Villata[2], Z. R. Weaver[1], H. Zhang[3], L. Dong[3], J. L. Gómez[4], M. V. Perel[5], S. S. Savchenko[6,7,8], V. M. Larionov[7,8,9], D. Carosati[10,11], W. P. Chen[12], O. M. Kurtanidze[13,14,15], A. Marchini[16], K. Matsumoto[17], F. Mortari[18], P. Aceti[19,20],

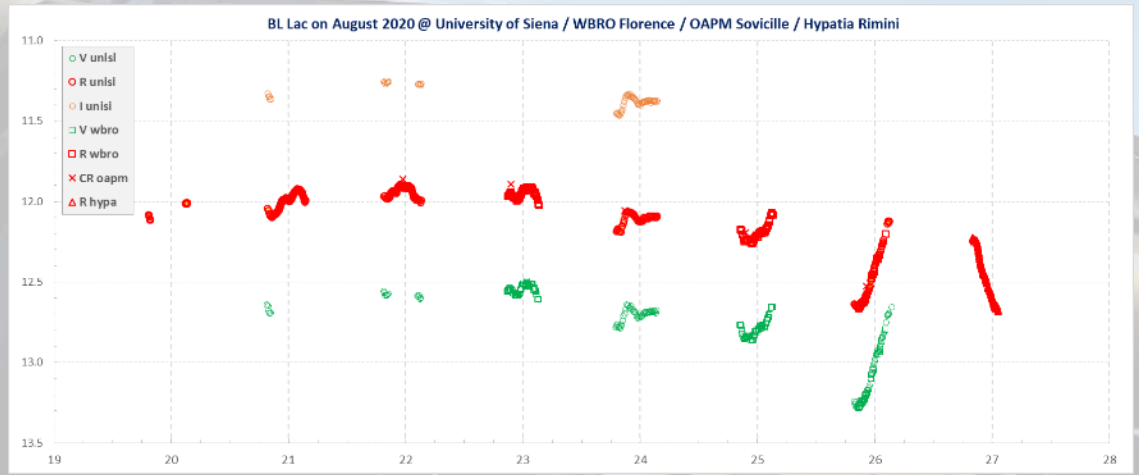
oato.inaf.it/blazars/webt/

Blazars: optical monitoring

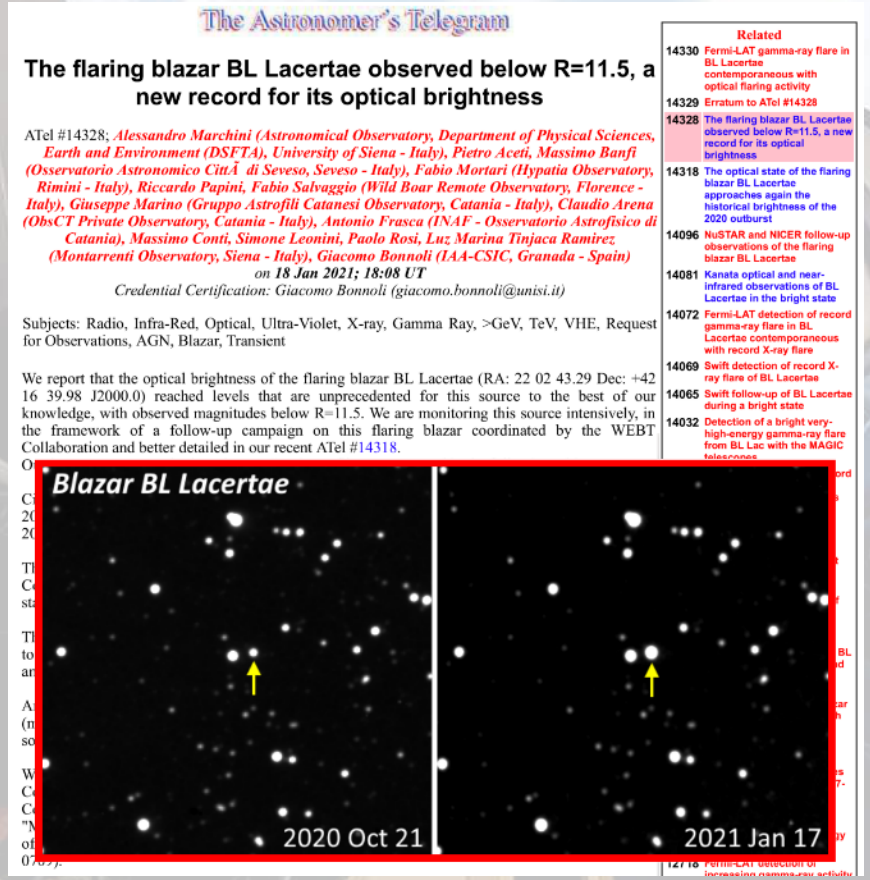








Blazars: immediate results of monitoring *(alerts)*



The Astronomer's Telegram

The flaring blazar BL Lacertae observed below R=11.5, a new record for its optical brightness

ATel #14328; *Alessandro Marchini (Astronomical Observatory, Department of Physical Sciences, Earth and Environment (DSFTA), University of Siena - Italy), Pietro Aceti, Massimo Banfi (Osservatorio Astronomico CittÀ di Seveso, Seveso - Italy), Fabio Mortari (Hypatia Observatory, Rimini - Italy), Riccardo Papini, Fabio Salvaggio (Wild Boar Remote Observatory, Florence - Italy), Giuseppe Marino (Gruppo Astrofili Catanesi Observatory, Catania - Italy), Claudio Arena (ObsCT Private Observatory, Catania - Italy), Antonio Frasca (INAF - Osservatorio Astrofisico di Catania), Massimo Conti, Simone Leonini, Paolo Rosi, Luz Marina Tinjaca Ramirez (Montarrenti Observatory, Siena - Italy), Giacomo Bonnoli (IAA-CSIC, Granada - Spain)*
on 18 Jan 2021; 18:08 UT
Credential Certification: Giacomo Bonnoli (giacomo.bonnoli@unisi.it)

Subjects: Radio, Infra-Red, Optical, Ultra-Violet, X-ray, Gamma Ray, >GeV, TeV, VHE, Request for Observations, AGN, Blazar, Transient

We report that the optical brightness of the flaring blazar BL Lacertae (RA: 22 02 43.29 Dec: +42 16 39.98 J2000.0) reached levels that are unprecedented for this source to the best of our knowledge, with observed magnitudes below R=11.5. We are monitoring this source intensively, in the framework of a follow-up campaign on this flaring blazar coordinated by the WEBT Collaboration and better detailed in our recent ATel #14318.

Related
14330 Fermi-LAT gamma-ray flare in BL Lacertae contemporaneous with optical flaring activity
14329 Erratum to ATel #14328
14328 The flaring blazar BL Lacertae observed below R=11.5, a new record for its optical brightness
14318 The optical state of the flaring blazar BL Lacertae approaches again the historical brightness of the 2020 outburst
14096 NuSTAR and NICER follow-up observations of the flaring blazar BL Lacertae
14081 Kanata optical and near-infrared observations of BL Lacertae in the bright state
14072 Fermi-LAT detection of record gamma-ray flare in BL Lacertae contemporaneous with record X-ray flare
14069 Swift detection of record X-ray flare of BL Lacertae
14065 Swift follow-up of BL Lacertae during a bright state
14032 Detection of a bright very-high-energy gamma-ray flare from BL Lac with the MAGIC telescopes

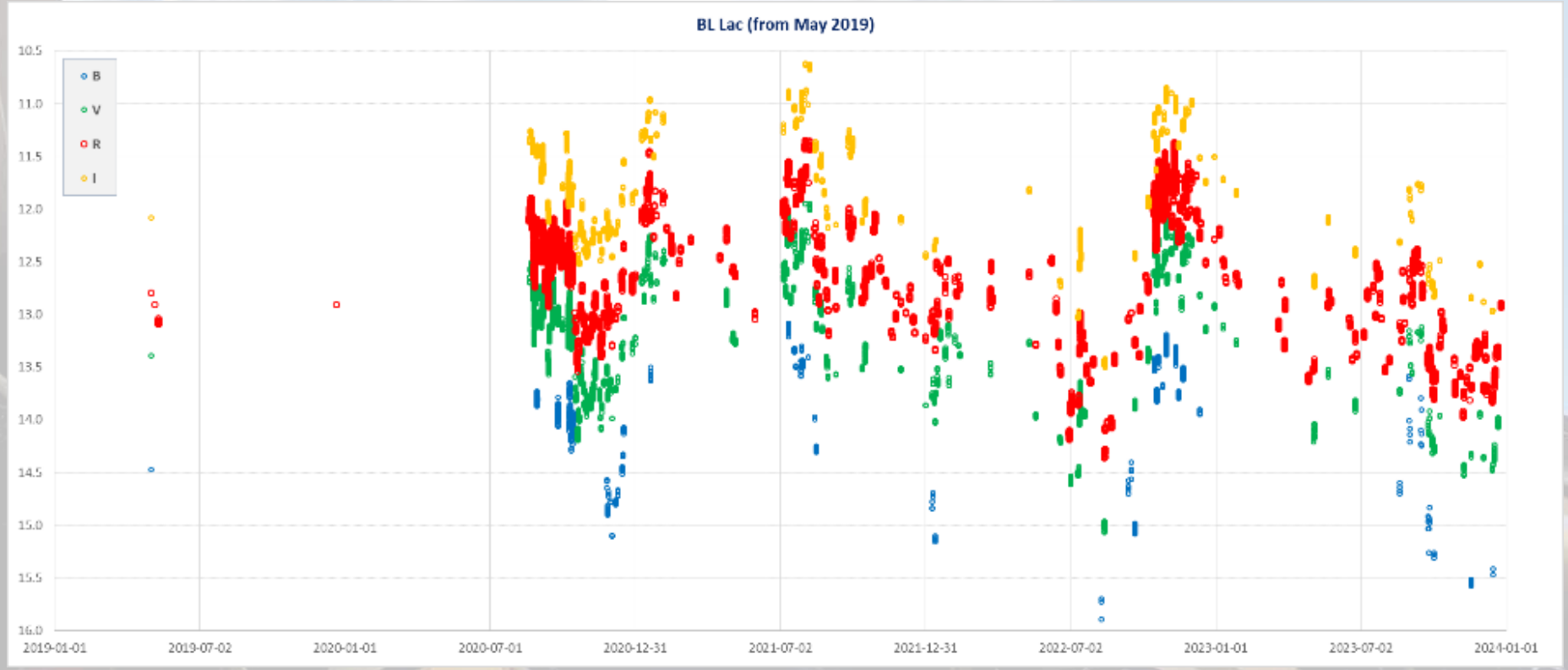
- **Worldwide alerts through Astronomer's Telegrams**
- **Alerts to our international collaborations**
  - *MAGIC*
  - *Tuorla Observatory (Finland)*
  - *WEBT (Whole Earth Blazar Telescope)*

WEBT: small Italian telescopes involved

- **University of Siena Astronomical Observatory (K54)**
  *Siena – **30 cm***
- **Catania Arena Private Observatory**
  *Catania – **20 cm***
- **GAC Gruppo Astrofili Catanesi Observatory**
  *Catania – **25 cm***
- **GiaGa Observatory (203)**
  *Pogliano Milanese (MI) – **36 cm***
- **Osservatorio Liceo Iris Versari di Cesano Maderno**
  *Felizzano (AL) – **20 cm***
- **Hypatia Observatory (L62)**
  *Rimini – **25 cm***
- **Montarrenti Observatory (C88)**
  *Sovicille (SI) – **53 cm***
- **Osservatorio Astronomico Città di Seveso (C24)**
  *Seveso – **30 cm***
- **Wild Boar Remote Observatory (K49)**
  *San Casciano Val di Pesa (FI) – **24 cm***
- **MarSEC – Marana Space Explorer Center**
  *Marana di Crespadoro (VI) – **36 cm***

- & a few others

WEBT – intensive campaign on BL Lacertae



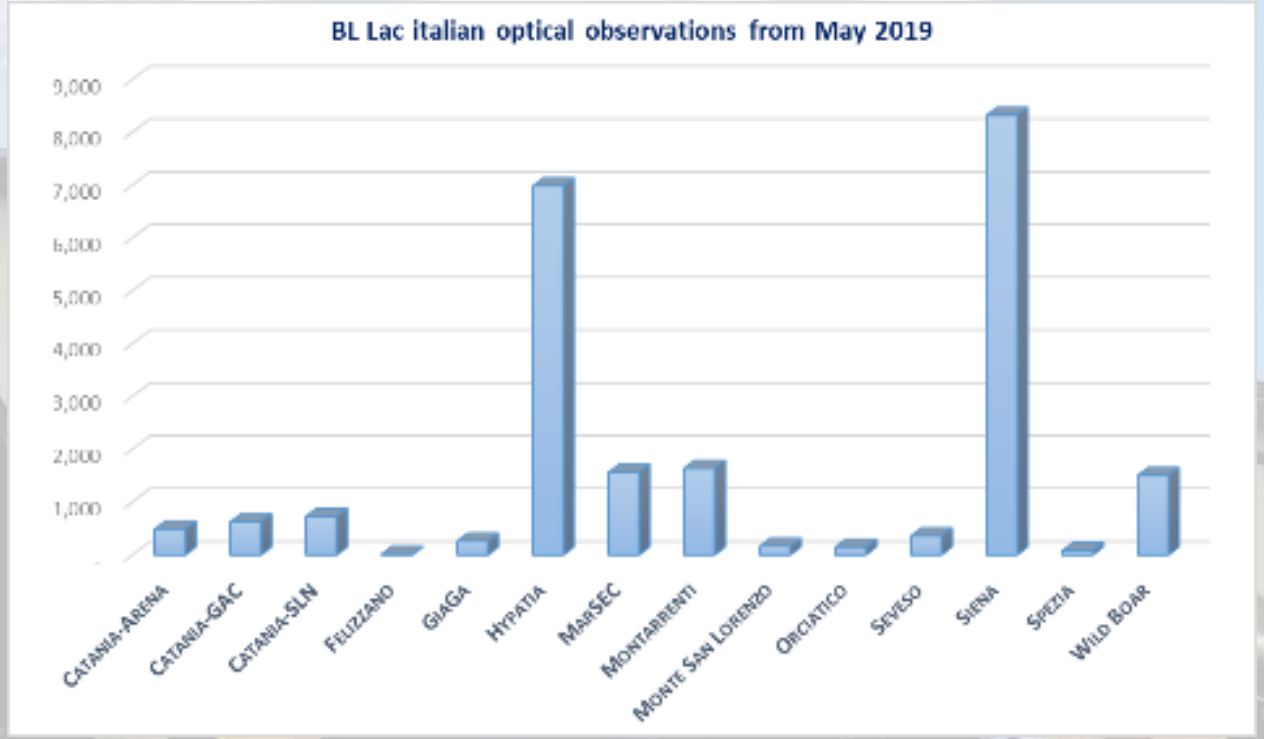
Data collected by Italian telescopes (Aug. 2020 - Dec. 2023)

WEBT – intensive campaign on BL Lacertae

Observatory	*Diam.*	*B*	*V*	*R*	*I*	*Total*	*Observers*
Catania-Arena	***0.20***	173	168	149	-	**490**	*Arena*
Catania-GAC	***0.25***	-	267	180	180	**627**	*Marino, Frasca*
Catania-SLN	***0.91***	157	162	233	177	**729**	*Frasca, Marino*
Felizzano	***0.20***	-	-	14	-	**14**	*Banfi*
GiaGa	***0.36***	12	116	136	-	**264**	*Galli*
Hypatia	***0.25***	-	154	6,833	-	**6,987**	*Mortari, Gabellini*
MarSEC	***0.36***	-	-	1,564	-	**1,564**	*Peretto, Lora*
Montarrenti	***0.53***	419	382	420	420	**1,641**	*Leonini, Conti, Rosi, Tinjaca Ramirez*
Monte San Lorenzo	***0.53***	-	-	165	-	**165**	*Mortari*
Orciatico	***0.30***	43	30	47	29	**149**	*Barbieri*
Seveso	***0.30***	-	70	293	-	**363**	*Banfi, Aceti*
Siena	***0.30***	1	1,930	4,912	1,481	**8,324**	*Marchini*
Spezia	***0.40***	-	41	41	-	**82**	*Scarfi*
Wild Boar	***0.24***	-	658	848	-	**1,506**	*Papini, Salvaggio, Banfi, Marino*
TOTALE		*805*	*3,978*	*15,835*	*2,287*	***22,905***	*since 2019 May 2*

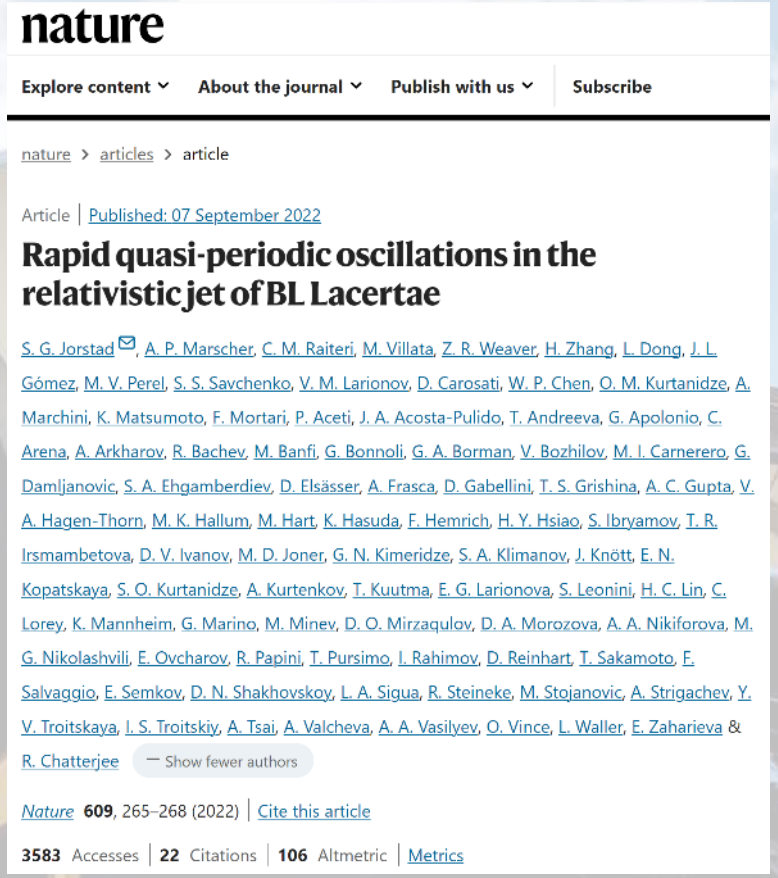
Data collected by Italian telescopes

WEBT – intensive campaign on BL Lacertae



Data collected by Italian telescopes

WEBT – a great achievement in 2022



nature

Explore content ∨ About the journal ∨ Publish with us ∨ Subscribe

nature › articles › article

Article | Published: 07 September 2022

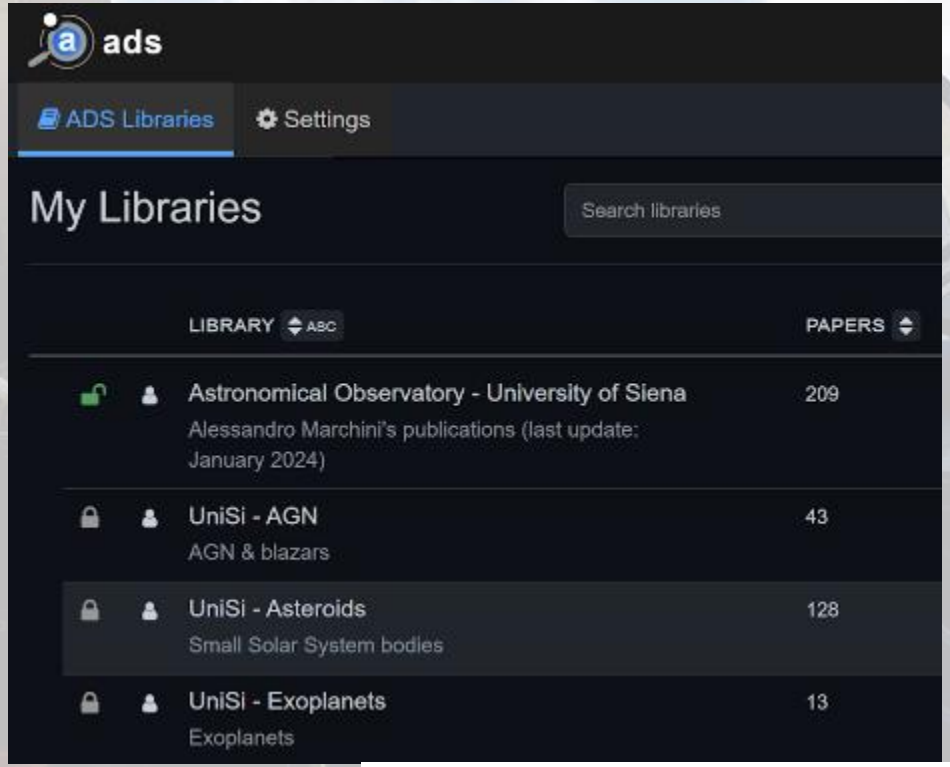
Rapid quasi-periodic oscillations in the relativistic jet of BL Lacertae

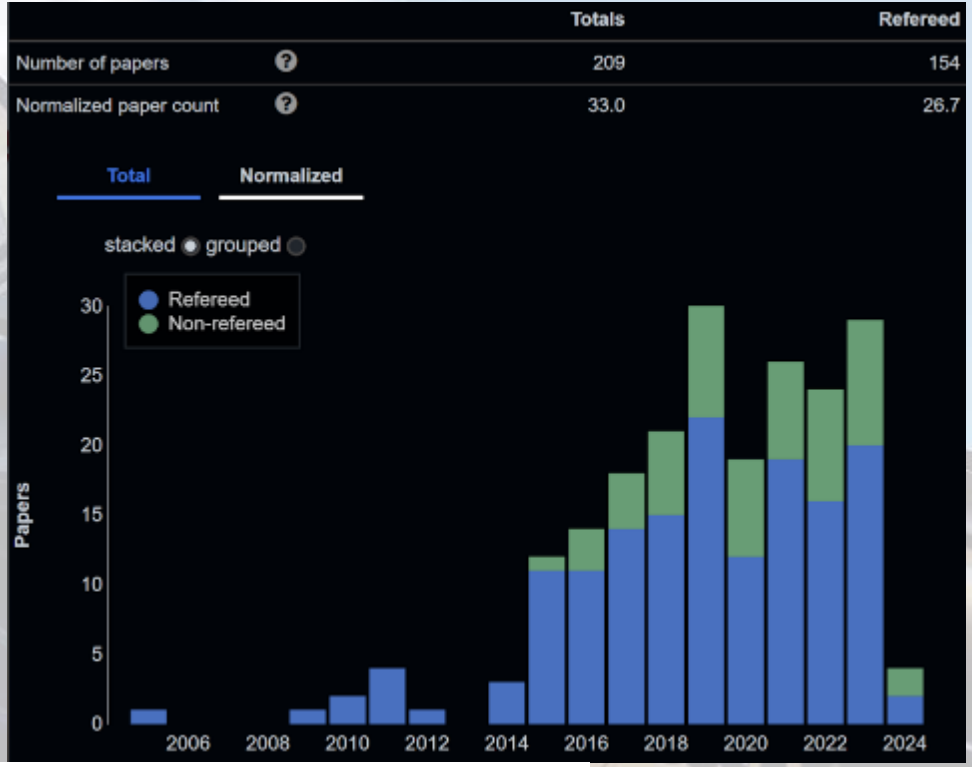
S. G. Jorstad, A. P. Marscher, C. M. Raiteri, M. Villata, Z. R. Weaver, H. Zhang, L. Dong, J. L. Gómez, M. V. Perel, S. S. Savchenko, V. M. Larionov, D. Carosati, W. P. Chen, O. M. Kurtanidze, A. Marchini, K. Matsumoto, F. Mortari, P. Aceti, J. A. Acosta-Pulido, T. Andreeva, G. Apolonio, C. Arena, A. Arkharov, R. Bachev, M. Banfi, G. Bonnoli, G. A. Borman, V. Bozhilov, M. I. Carnerero, G. Damljanovic, S. A. Ehgamberdiev, D. Elsässer, A. Frasca, D. Gabellini, T. S. Grishina, A. C. Gupta, V. A. Hagen-Thorn, M. K. Hallum, M. Hart, K. Hasuda, F. Hemrich, H. Y. Hsiao, S. Ibryamov, T. R. Irsmambetova, D. V. Ivanov, M. D. Joner, G. N. Kimeridze, S. A. Klimanov, J. Knött, E. N. Kopatskaya, S. O. Kurtanidze, A. Kurtenkov, T. Kuutma, E. G. Larionova, S. Leonini, H. C. Lin, C. Lorey, K. Mannheim, G. Marino, M. Minev, D. O. Mirzaqulov, D. A. Morozova, A. A. Nikiforova, M. G. Nikolashvili, E. Ovcharov, R. Papini, T. Pursimo, I. Rahimov, D. Reinhart, T. Sakamoto, F. Salvaggio, E. Semkov, D. N. Shakhovskoy, L. A. Sigua, R. Steineke, M. Stojanovic, A. Strigachev, Y. V. Troitskaya, I. S. Troitskiy, A. Tsai, A. Valcheva, A. A. Vasilyev, O. Vince, L. Waller, E. Zaharieva & R. Chatterjee — Show fewer authors

Nature **609**, 265–268 (2022) | Cite this article

3583 Accesses | **22** Citations | **106** Altmetric | Metrics

Research results: *publications*





ui.adsabs.harvard.edu/public-libraries/_C4IjE8kQ2K75AO6LdStfA

Publications *highlights*

nature

Explore content | About the journal | Publish with us

nature > articles > article

Article | Open Access | Published: 23 November 2022

Polarized blazar X-rays imply particle acceleration in shocks

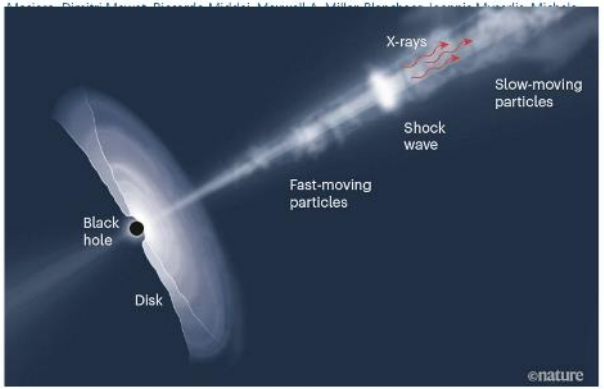
Alessandro Marchini View ORCID ID profile

Department of Physical Sciences, Earth and Environment, Astronomical Observatory, University of Siena, Siena, Italy

View author publications

You can also search for this author in PubMed | Google Scholar

Alessandro Marchini, Herman L. Marshall, Daria A. Morozova, Francesco Massaro, Joseph R.



nature astronomy

Explore content | About the journal | Publish with us | Subscribe

nature > nature astronomy > articles > article

Article | Published: 17 July 2023

Discovery of X-ray polarization angle rotation in the jet from blazar Mrk 421

Laura Di Gesu, Herman L. Marshall, Steven R. Ehlert, Dawoon E. Kim, Immacolata Donnarumma, Fabrizio Tavecchio, Ioannis Liodakis, Sebastian Marscher, Simonetta Puccetti, Riccard Romani, Alessandro Di Marco, Dmitry Mandarakas, Stylianos Romanopoulos, Ioannis Myserlis, Mark A. Gurwell, Ram Francisco José Aceituno, Maria I. Berna Beatriz Agís-González, César Husillos, Alessandro Marchini, Alfredo Sota, Ryo Imazawa, Mahito Sasada, Yasushi Fukazawa, Koji S. Kawabata, Makoto Uemura, Tsunefumi Mizuno, Tatsuya Nakaoka, Hiroshi Akitaya, Sergey S. Savchenko, Andrey A. Vasilyev, José L. Gómez, Lucio A. Antonelli, Thibault Barnouin, Raffaella Bonino, Elisabetta Cavazzuti, Luigi Costamante, Chien-Ting Chen, Nicolò Cibrario, Alessandra De Rosa, Federico Di Pierro, Manel Errando, Philip Kaaret, Vladimir Karas, Henric Krawczynski, Lindsey Lisalda, Grzegorz Madejski, Christian Malacaria, Frédéric Marin, Andrea Marinucci, Francesco Massaro, Giorgio

Alessandro Marchini View ORCID ID profile

University of Siena, Astronomical Observatory, Siena, Italy

View author publications

nature

View all journals | Search | Login

Explore content | About the journal | Publish with us

nature > articles > article

Article | Published: 07 September 2022

Rapid quasi-periodic oscillations in the relativistic jet of BL Lacertae

S. G. Jorstad, A. P. Marscher, C. M. Raiteri, M. Villata, Z. R. Weaver, H. Zhang, L. Dong, J. L. Gómez, M. V. Perel, S. S. Savchenko, V. M. Larionov, D. Carosati, W. P. Chen, O. M. Kurtanidze, A. Marchini, K. Matsumoto, F. Mortari, P. Aceti, J. A. Acosta-Pulido, T. Andre

+ Show authors

A. Marchini

Astronomical Observatory, Department of Physical Sciences, Earth and Environment, University of Siena, Siena, Italy

Nature **609**, 265–268 (2022) | Cite t

6 Altmetric | Metrics

Abstract

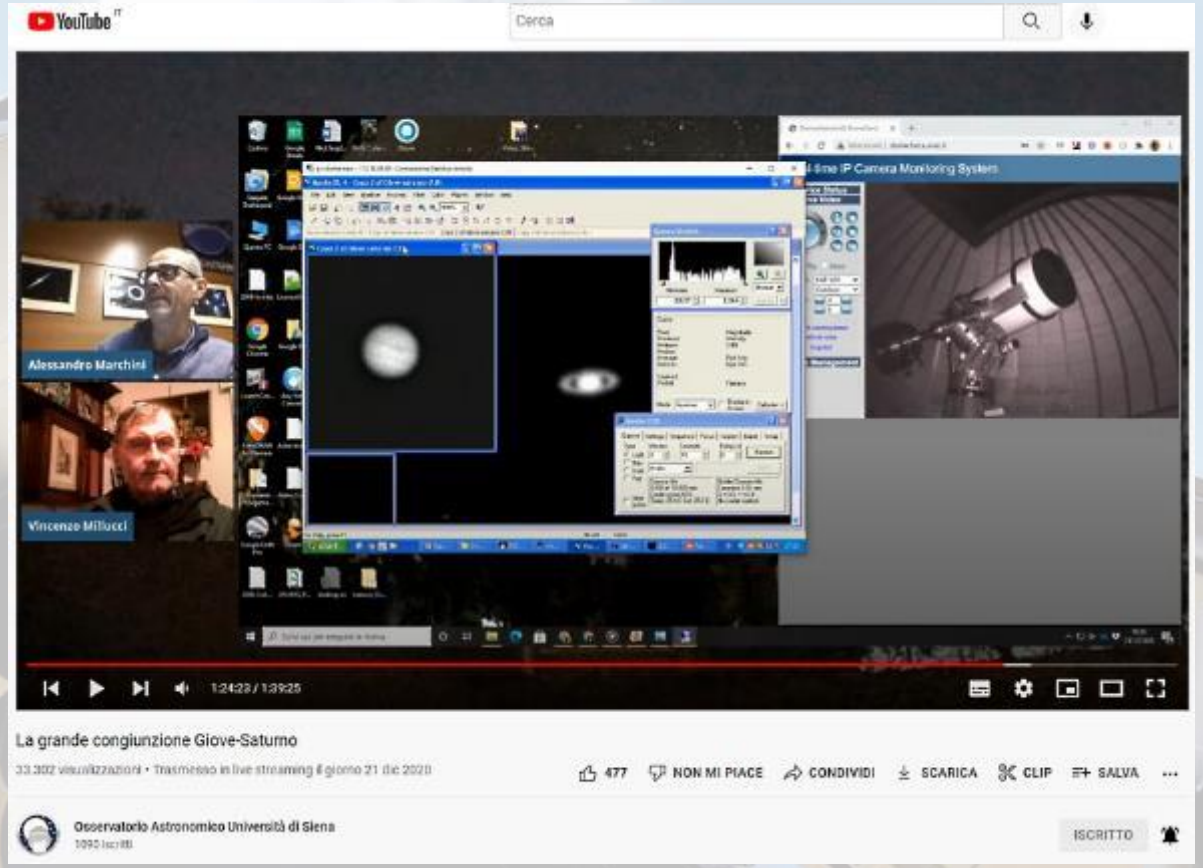
Blazars are active galactic nuclei (AGN) with relativistic jets whose non-thermal radiation is extremely variable on various timescales[1,2,3]. This variability seems mostly random, although some quasi-periodic oscillations (QPOs), implying systematic processes, have been reported in blazars and other AGN. QPOs with timescales of days or hours are especially rare[4] in AGN and their nature is highly debated, explained by emitting plasma moving helically inside the jet[5], plasma instabilities[6,7] or orbital motion in an accretion disc[7,8]. Here we report results of intense optical and γ-ray flux monitoring of BL Lacertae (BL Lac) during a dramatic outburst in 2020 (ref. [9]). BL Lac, the prototype of a subclass of blazars[10], is powered by a 1.7×10^8 M_{Sun} (ref. [11]) black hole in an elliptical galaxy (distance = 313 megaparsecs (ref. [12])). Our observations show QPOs of optical flux and linear polarization, and γ-ray flux, with cycles as short as approximately 13 h during the highest state of the outburst. The QPO properties match the expectations of current-driven kink instabilities[6] near a recollimation shock about 5 parsecs (pc) from the black hole in the wake of an apparent superluminal feature moving down the jet. Such a kink is apparent in a microwave Very Long Baseline Array (VLBA) image.

Other activities: *education*

Other activities: *education*

Other activities: *outreach*

2020-2021: *live shows* during the Covid-19 pandemic



2022: Elisa defends her PhD thesis...

Despite her disability, Elisa certainly taught me more than I did with her.

NEVER GIVE UP!

THANK YOU

Alessandro Marchini
marchini@unisi.it

Università degli Studi di Siena, DSFTA, Osservatorio Astronomico
INAF – Osservatorio Astronomico di Brera

facebook.com/**astro.unisi**
instagram.com/**astro.unisi**
youtube.com/**@astrounisi**