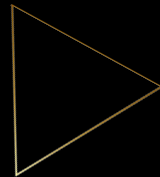


THE GALAXY THAT DRAMATICALLY CHANGED THE DIRECTION OF ITS RELATIVISTIC JET

Lorena Hernández-García
University of Valparaíso (UV), Chile

F. Panessa, G. Bruni, L. Bassani, A. Bazzano, P. Ubertini, P. Arévalo, V. M. Patiño-Alvarez, P. Lira, P. Sánchez-Sáez, F. E. Bauer, V. Chavushyan, R. Carraro, F. Förster, A. M. Muñoz Arancibia, A. Tramacere, M. Giroletti, ; G. Ghisellini

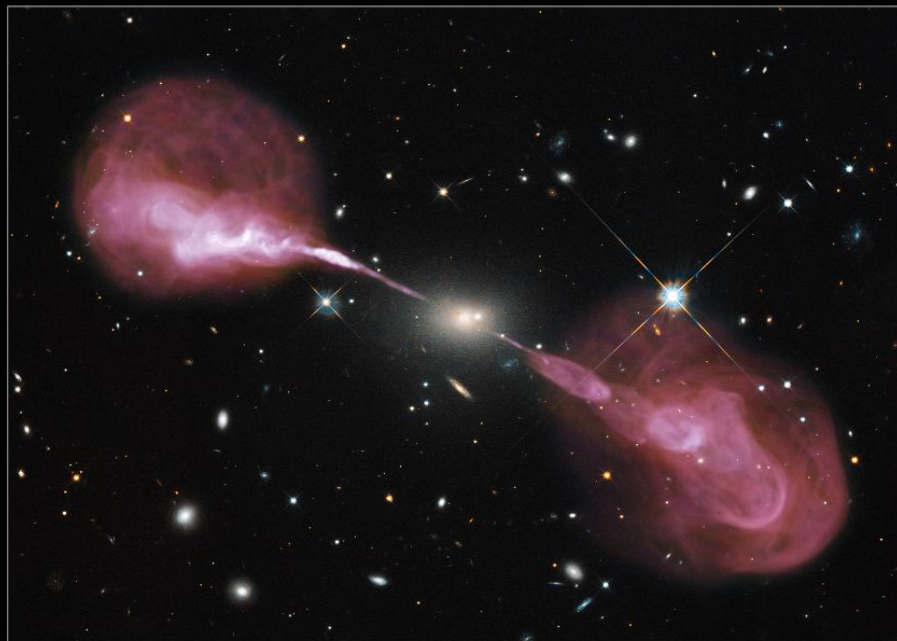
GIANT RADIO GALAXIES



- Extended emission > 0.7 Mpc
(Ishwara-Chandra & Saikia 1999)
- Spectral ages can be 10^7 - 10^8 yr
(Alexander & Leahy 1987)

Perfect laboratories to study
intermittent activity
and Active Galactic Nuclei
(AGN) evolution.

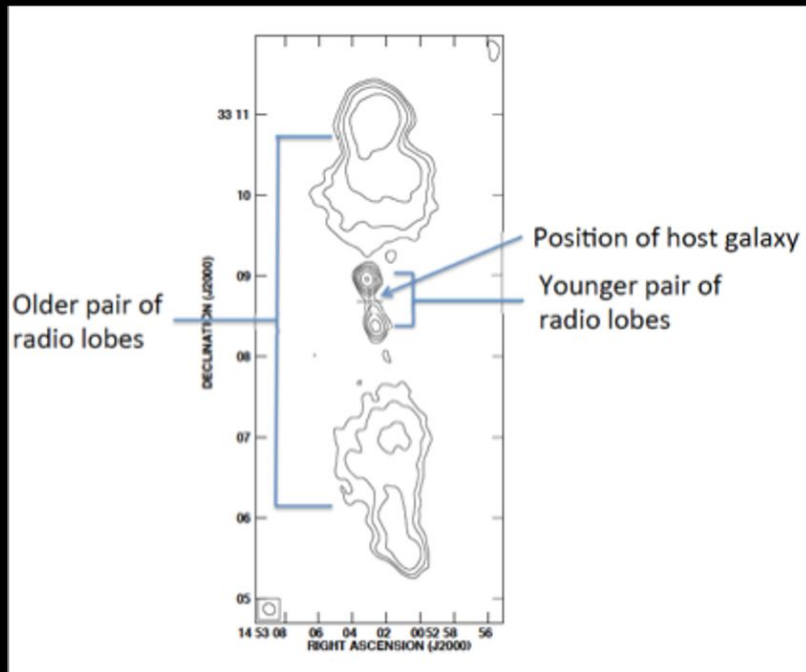
Radio Galaxy Hercules A



GIANT RADIO GALAXIES

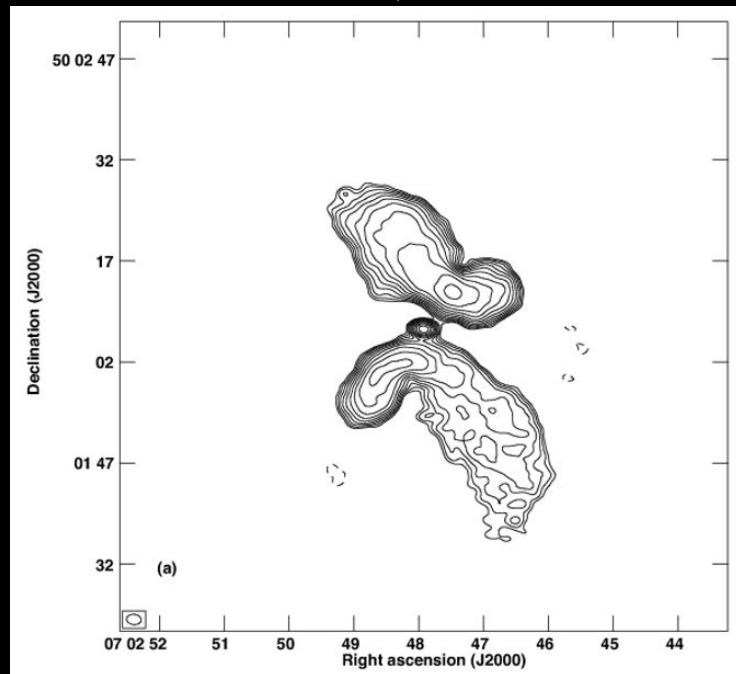
Double-double radio galaxies (DDRG)

(Lara et al. 1999, Schoenmakers et al 2000)



X-shaped radio galaxies (XRG)

(Rottmann et al. 2001, Gopal-Krishna et al. 2012)



Credits: DDRG J1453+3308 at 334 MHz (Konar et al. 2006)

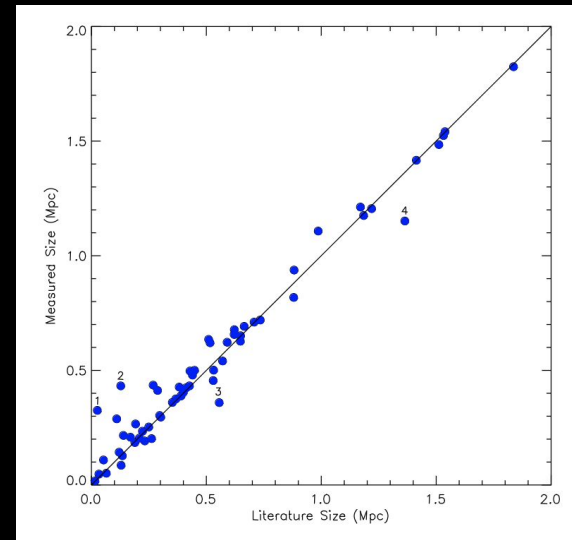
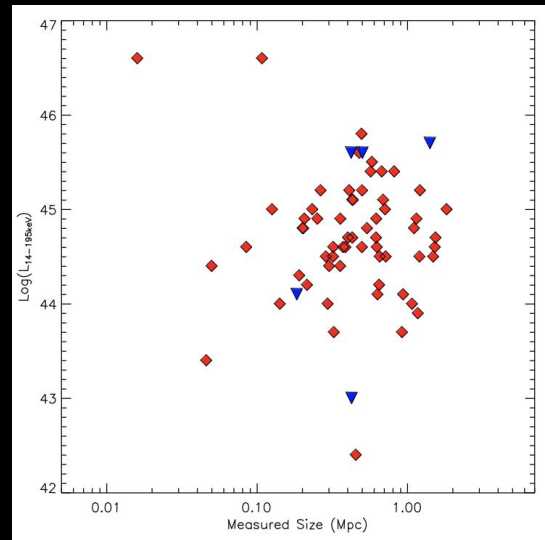
Credits: XRG J0702+5002 at 512 MHz (Roberts et al. 2015)

GIANT RADIO GALAXIES

- Crossmatch of :
INTEGRAL/IBIS + Swift/BAT and NVSS + FIRST + SUMS
- Visual inspection of 1000 images, searching for extended structures

67 radio galaxies with
double morphology

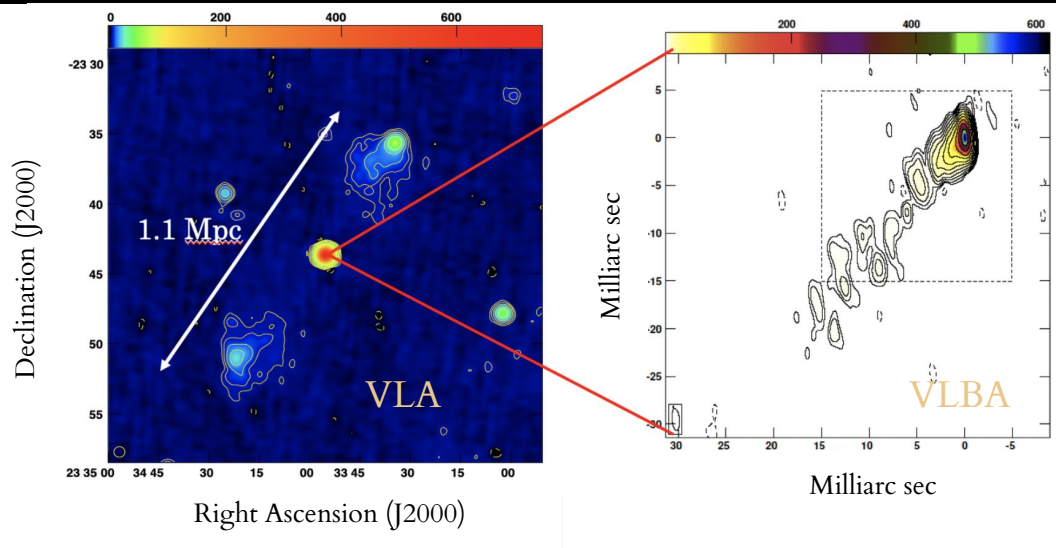
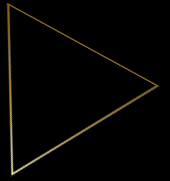
15 GRGs >0.7 Mpc (22%)



PBC J2333.9-2343

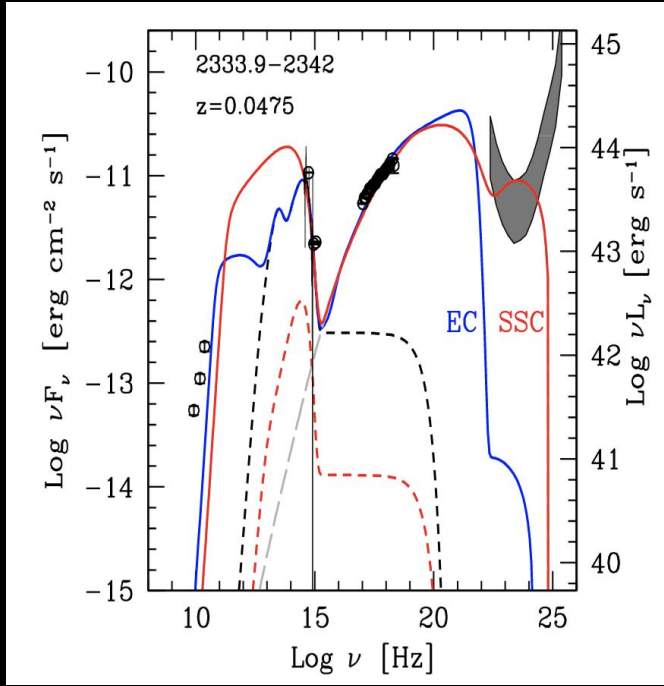
- Selected from the INTEGRAL sample because of its different classifications (Bassani et al. 2016), $z = 0.047$ (Parisi et al. 2014)
- Giant radio galaxy (Bassani et al. 2016)
- Classified as Seyfert 2 in the optical, with $z = 0.0475$ (Parisi et al. 2012)
- Unobscured at X-rays, i.e., type 1? (Parisi et al. 2012)
- Blazar at radio frequencies (Massaro et al. 2009), jet in VLBI at 8.4 GHz (Ojha et al. 2004)

PBC J2333.9-2343



- Simultaneous observations in 2015:
VLBA/XMM-Newton/SPM
- VLA shows two jets / VLBA shows one jet with < 40 degrees

PBC J2333.9-2343

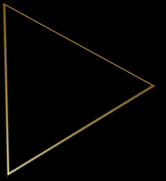


- Synchrotron Self Compton (SSC) and External Compton (EC) models
- Spectral energy distribution (SED) constraints the angle to 6 degrees



HYPOTHESIS:

A BLAZAR-LIKE CORE AT THE CENTER OF THE RADIO GALAXY



MONITORING IN 2018-19

- Effelsberg -> Radio 4.8, 8.5, 10.5, 20.4 GHz
- SMARTS-1.3m -> simultaneous NIR/optical K/I
- Swift (XRT/UVOT) -> 0.5-10 KeV, UVM2
- Zwicky Transient Facility (ZTF) -> optical g,r,i
- Asteroid Terrestrial-impact Last Alert System (ATLAS) -> optical o,c

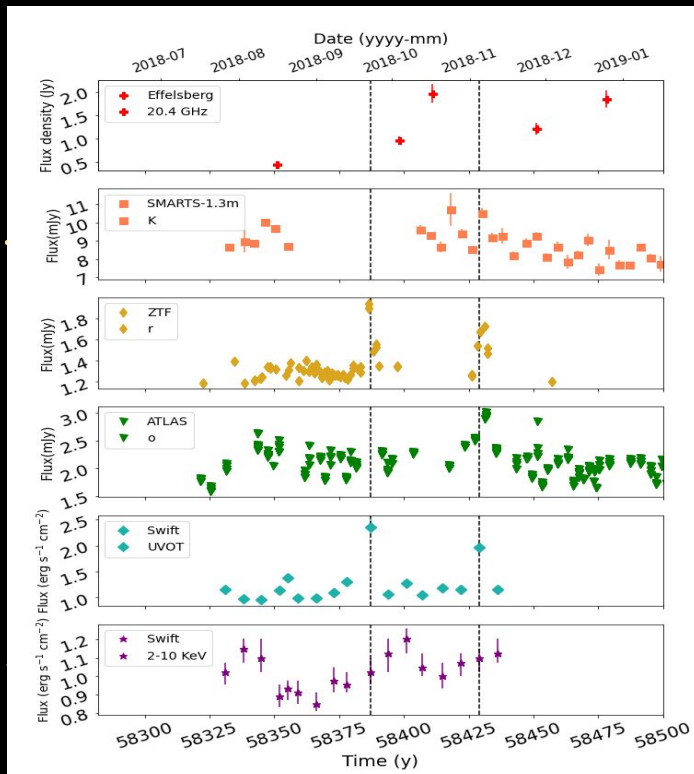
- Fermi -> Gamma rays -> **6 sigma detection**
- VLBA -> Radio
- RACS -> Radio
- VLASS -> Radio

2018: 3-4 days cadence

2019: daily cadence

MONITORING IN 2018-19

Hernández-García et al. (in prep.)



77 %

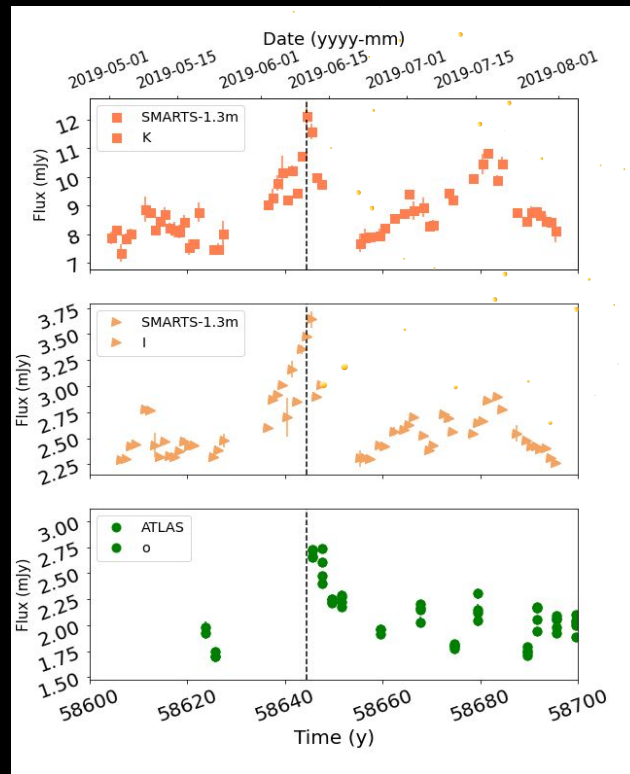
31 %

39 %

48 %

59 %

29 %

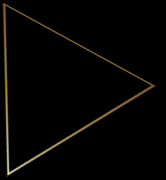


40 %

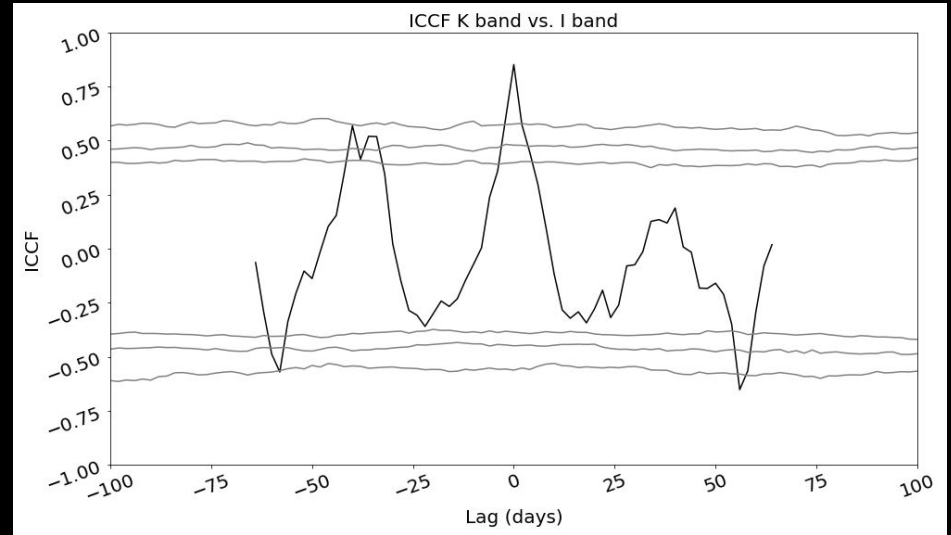
38 %

38 %

MONITORING IN 2018-19



- Cross Correlation Function (CCF)
- SMARTS-1.3m \rightarrow K/I
- 1.02 ± 1.45 days



DISCUSSION

1.02 ± 1.45 days

Variability timescales



~~Torus~~

~~80 days~~

~~(Koshida et al. 2014; Minezaki et al. 2019)~~

~~Accretion disk~~

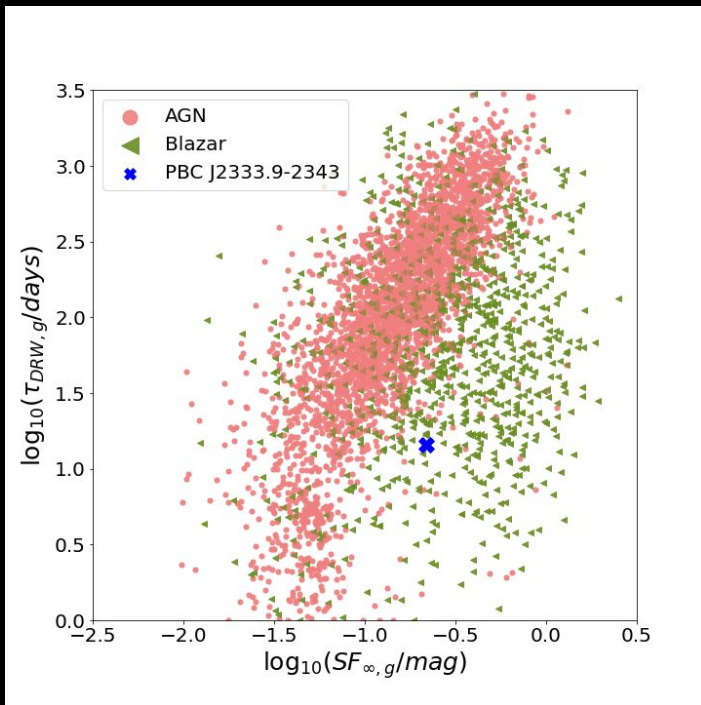
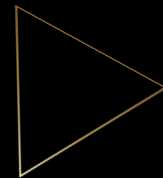
~~7.5 days~~

~~(Lira et al. 2015)~~

Jet

Simultaneous
Bonning et al. (2012)

DISCUSSION



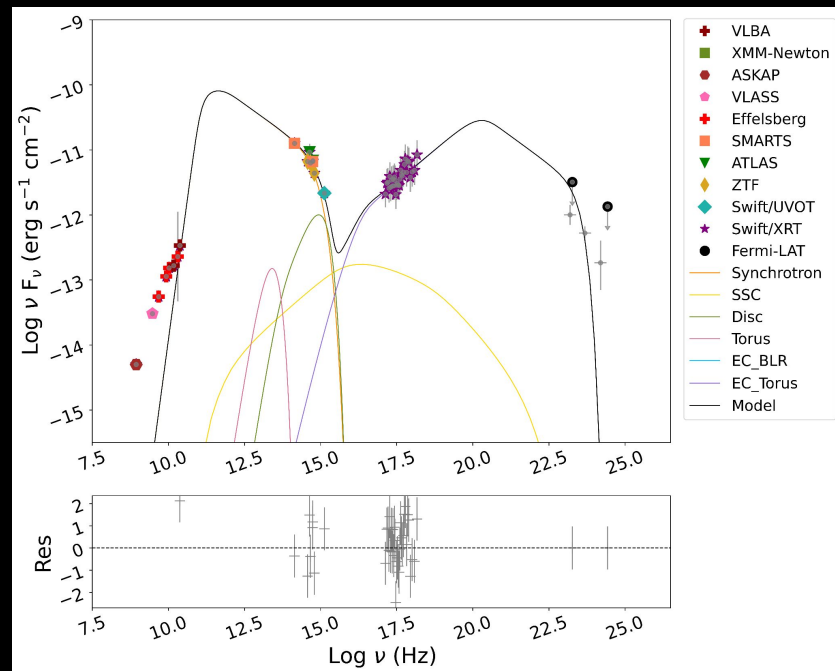
- Comparison with samples of AGN and Blazar
- Using features from the ALeRCE broker (Förster et al. 2021, Sánchez-Sáez et al. 2019)
- Damped Random Walk parameters to differentiate (MacLeod et al. 2011)

SPECTRAL ENERGY DISTRIBUTION

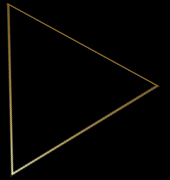
- Spectral Energy Distribution (SED)
- Fitted using JetSet (Tramacere et al. 2009, 2011)



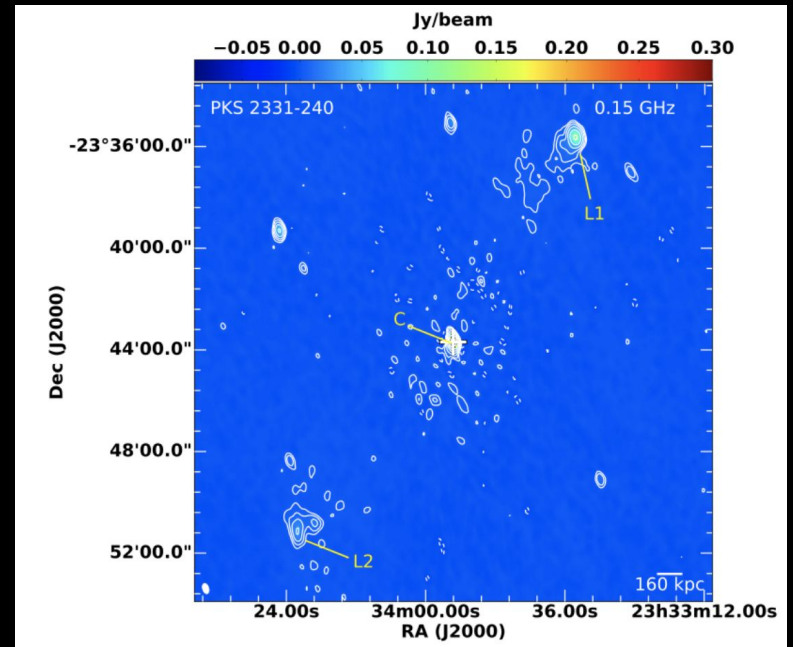
- External Compton (EC) with mild Synchrotron Self Compton model (SSC)
- Jet angle 3 degrees



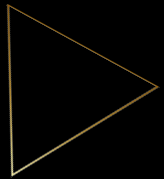
PBC J2333.9-2343



- Deep GMRT image shows a lack of emission between the nucleus and the core (Bruni et al. 2020)



Bruni et al. (2020)

With the Zwicky Transient Facility (ZTF) 
we started to find interesting sources



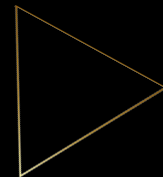
WATCHLIST



ALeRCE

Automatic Learning for the
Rapid Classification of Events

(Förster et al. 2021, Sánchez-Sáez et al. 2019)

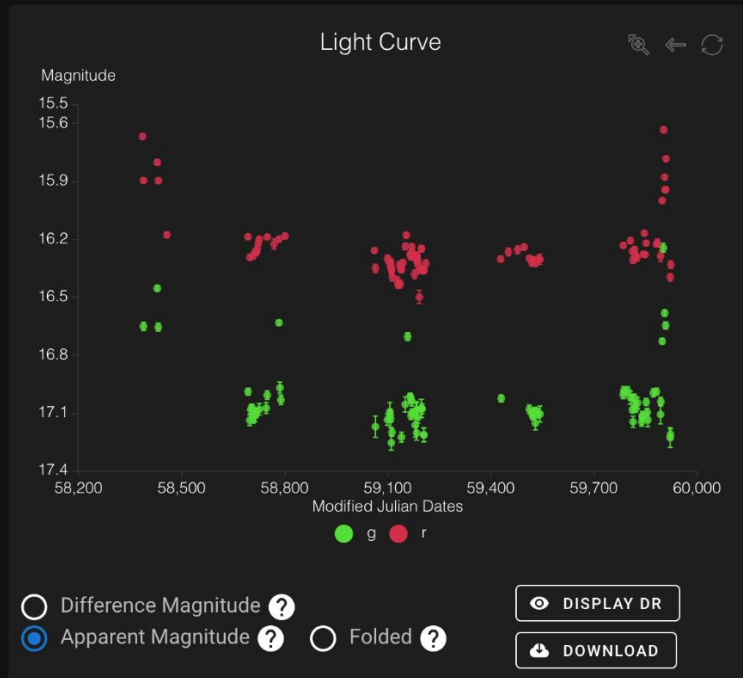


ALeRCE ZTF Explorer

ALeRCE Main Page

SN Hunter

Object	ZTF18abwpdny	
Corrected	yes	
Stellar	no	
Detections	165	
Discovery date	Tue, 25 Sep 2018 07:01:44 UTC	
Last detection	Sun, 11 Dec 2022 04:03:31 UTC	
Non Detections	0	
RA(J2000)	353.48014933636364	
Dec(J2000)	-23.72792983090909	
FINDING CHART OTHER ARCHIVES		
Type	Name	Redshift
-	2018igu	Provided by TNS



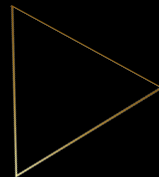
WATCHLIST

<https://watchlist.alerce.online/>




ALeRCE

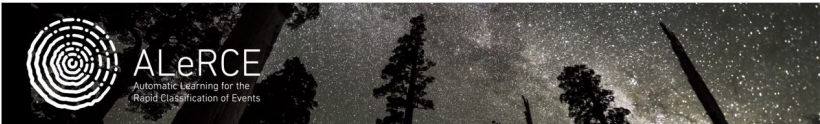
Automatic Learning for the
Rapid Classification of Events




Interesting sources watchlist notification. Externo Recibidos x

 **alercbroker@gmail.com** a través de amazonses.com
para mí ▾

🌐 inglés ▾ > español ▾ [Traducir mensaje](#)



 **ALeRCE**
Automatic Learning for the
Rapid Classification of Events

Interesting sources watchlist notification.

You're receiving this email because some watchlists got new matches.

This is the list with the targets and their matches:

- PBCJ2333.92343
 - ZTF18abwpdny: <http://alerce.online/object/ZTF18abwpdny>

Thanks for using our site!

The ALeRCE team

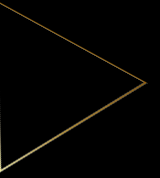
ALeRCE Team, Chile 2021

WATCHLIST



ALeRCE

Automatic Learning for the
Rapid Classification of Events



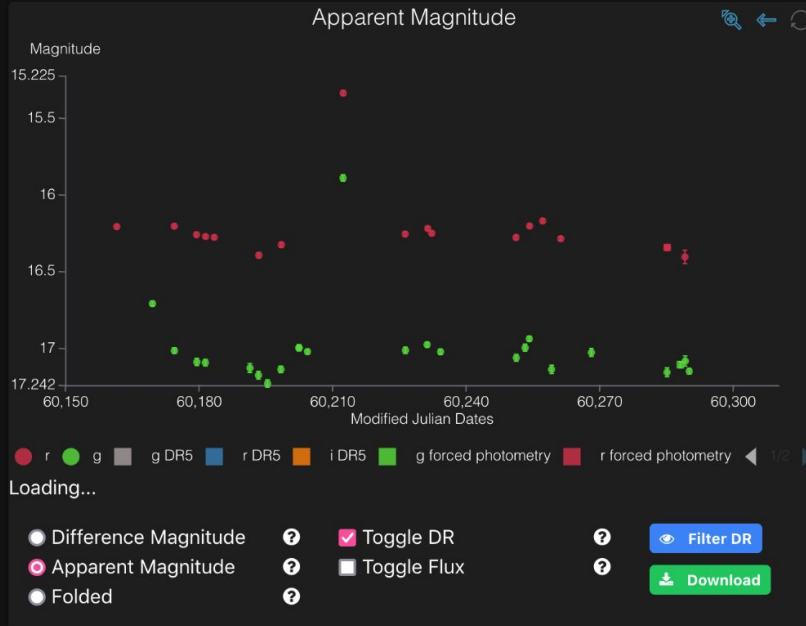
ALeRCE ZTF Explorer

[ALeRCE Main Page](#)

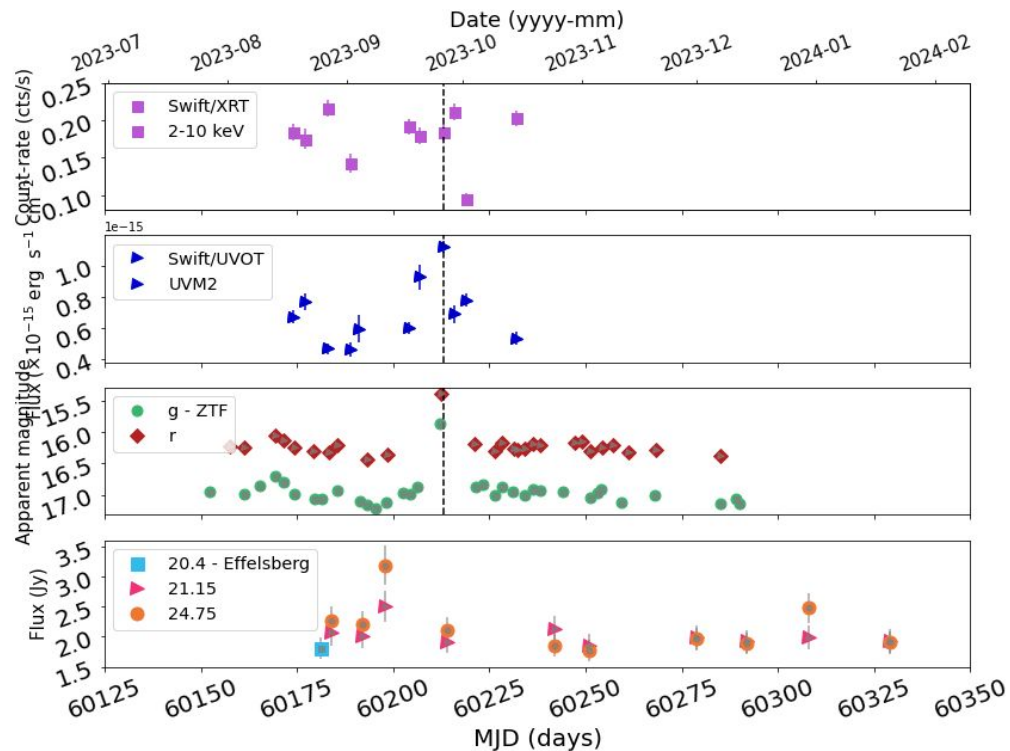
[SN Hunter](#)



Object	ZTF18abwpdny
Corrected	yes
Stellar	no
Detections	247
Discovery date	Tue, 25 Sep 2018 07:01:44 UTC
Last detection	Mon, 21 Oct 2024 06:28:34 UTC
Non Detections	141
RA(J2000)	353.4801799598268
Dec(J2000)	-23.72787806494944
FINDING CHART OTHER ARCHIVES	
Type	Name Redshift
-	2018igu



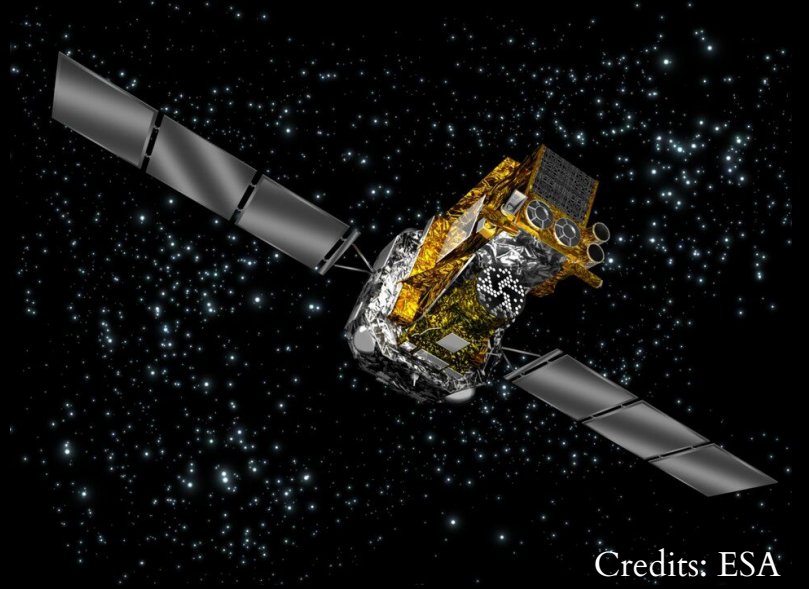
MONITORING DURING OUTBURST



- Alerts started in September 2023 with ZTF
- ToO activated with Swift and Effelsberg

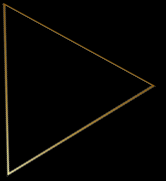
MONITORING DURING OUTBURST

- Approved observations during AO21
- Monitoring with INTEGRAL + Swift
- Complemented by ZTF and Effelsberg observations



Credits: ESA

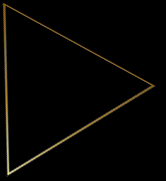
CONCLUSIONS



- Fermi detection at 6 sigma
- Variability at all observed wavelengths with flaring behaviour
- Optical/NIR occur simultaneously
- SED of a blazar with jet angle 3 degrees
- Optical variability features comparable to the blazar population
- No connection between the nucleus and the lobes

CONFIRMATION OF A BLAZAR-LIKE NUCLEUS AT THE CENTER OF THE GRG

CONCLUSIONS



THANKS!

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