



FERMI transient J1544-0649

a flaring radio-weak BL Lac

Gabriele Bruni (INAF-IAPS)

Collaborators:

F. Panessa, A. Bazzano, P. Ubertini (INAF-IAPS)
G. Ghisellini (INAF-OABr) L. Bassani, F. Ursini (INAF-OAS)
L. Hernandez-Garcia (IFA-U.Valparaiso)
V. Chavushyan, H. A. Pena-Herazo (INAOE)
A. Kraus (MPIfR)

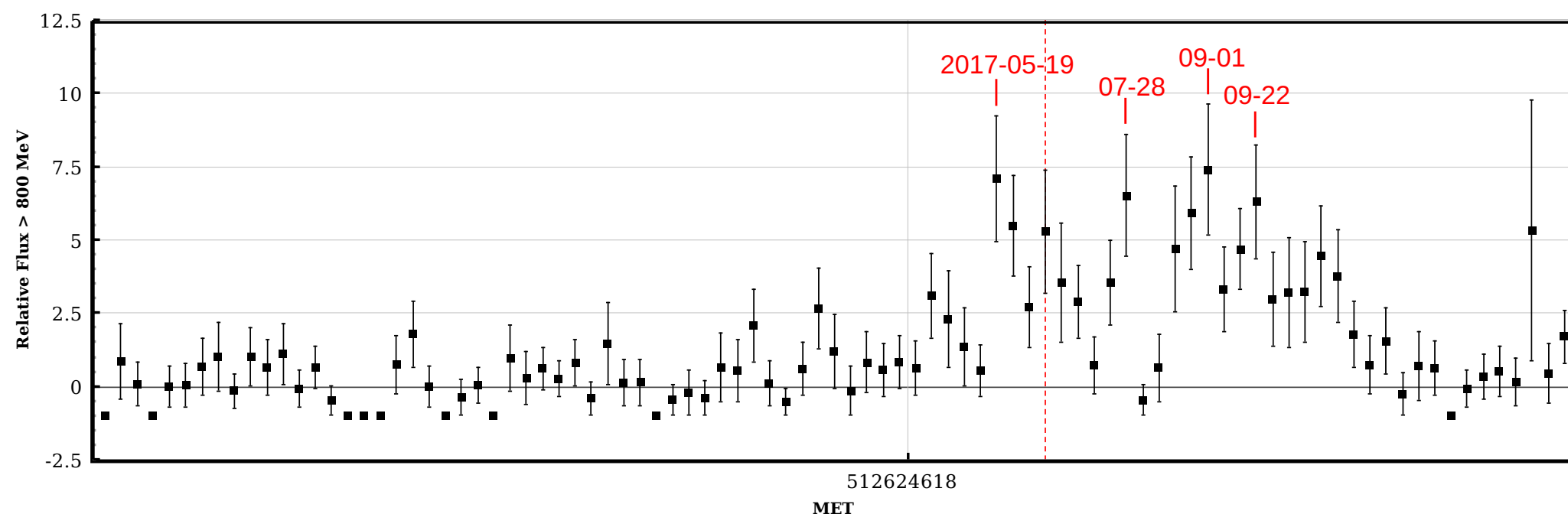
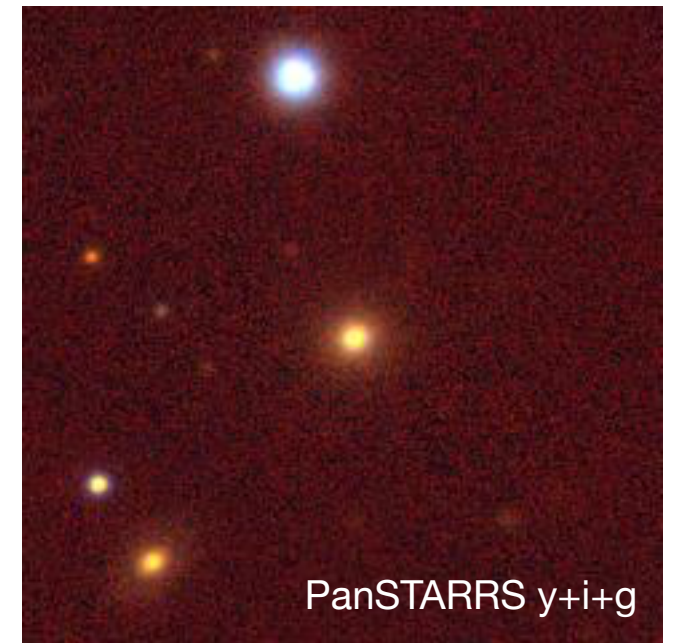
Half a century of Blazars and beyond - Turin, 11-15 June 2018

Intro

- With the release of the FERMI catalogue revealed several unmatched gamma-ray source
- Radio-weak BL Lacs are among these and have no radio counterpart in the main surveys (FIRST, NVSS)
- A handful of these objects have been found until now, difficult identification when no broad-band data are available
- Crucial importance for the unification scenario of AGN

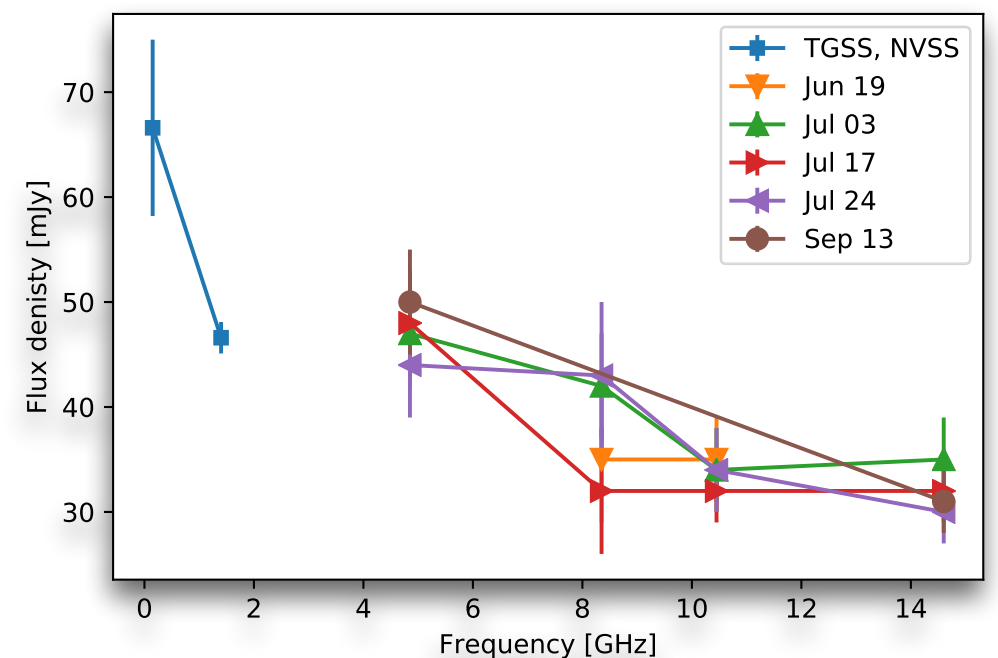
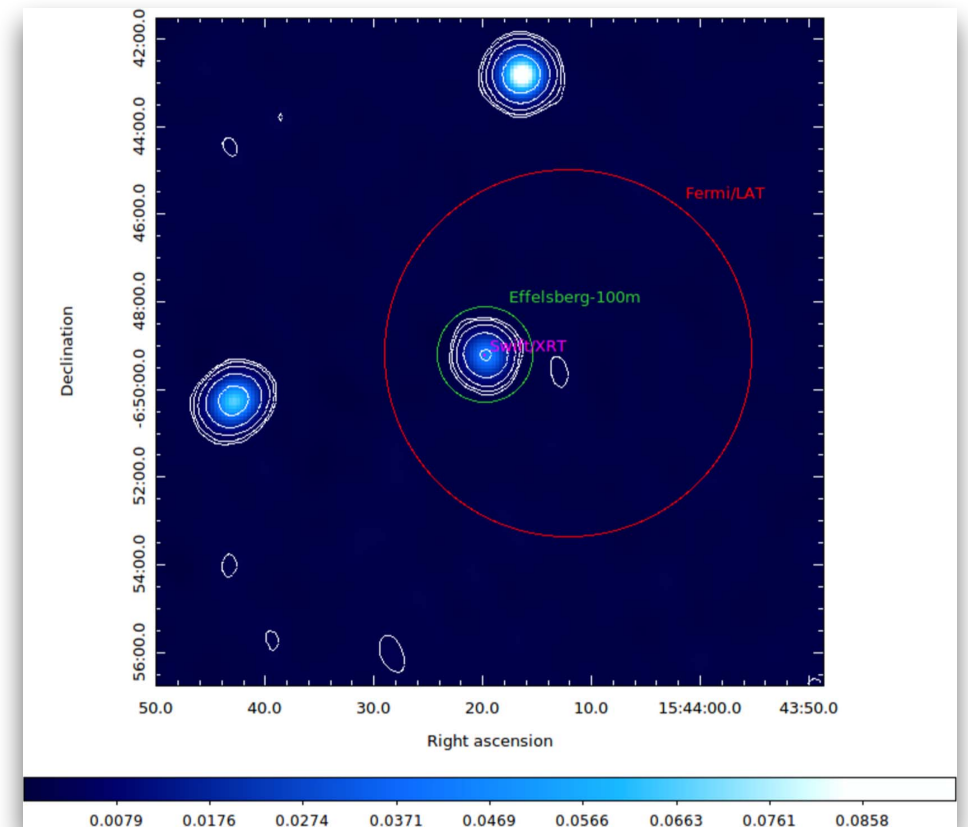
FERMI transient J1544-0649

- Outburst from a newly-found source was detected by Fermi/LAT on May 15, 2017, visible for 2 consecutive weeks (Ciprini et al. 2017, ATel #10482)
- X-ray counterpart detected by Swift/XRT, still active after 12 months
- Optical transient detected as well, host galaxy at $z=0.171$



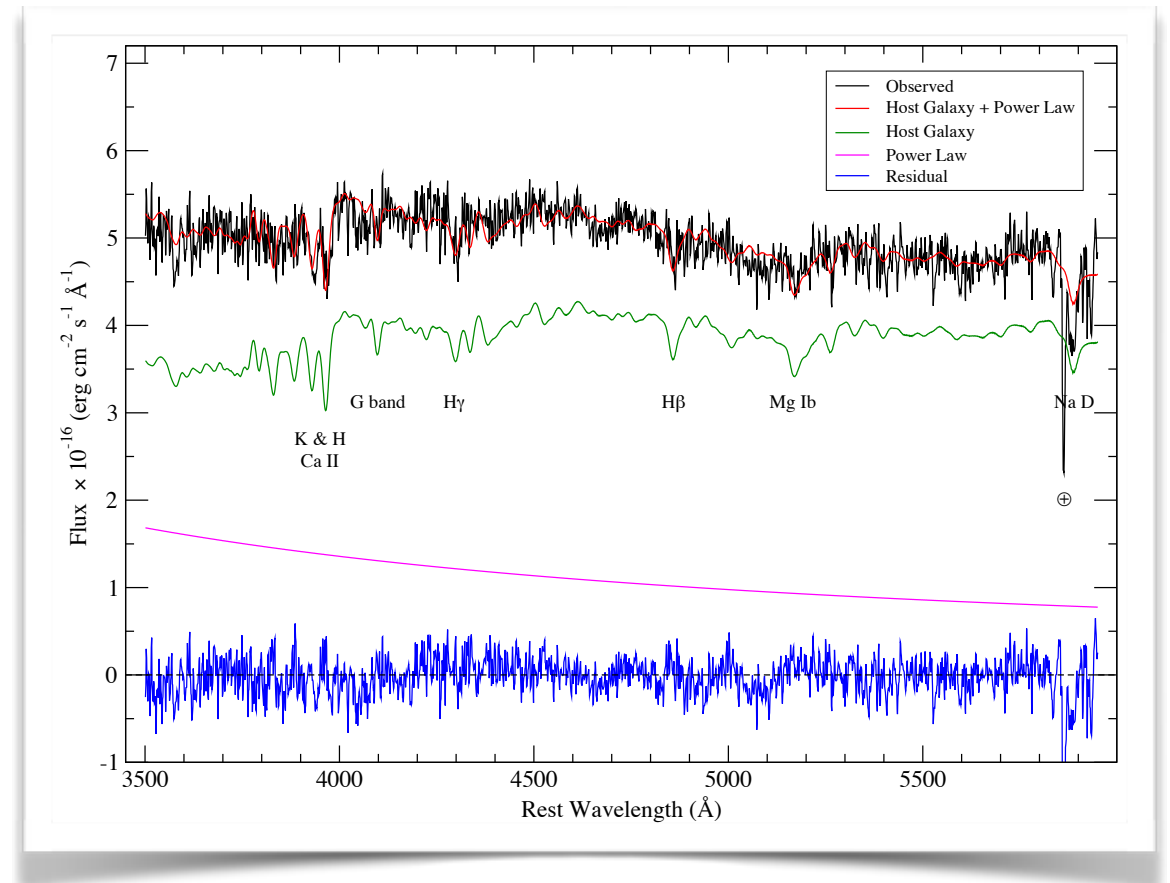
Monitoring campaign

- Position coincident with faint NVSS and TGSS object (1.4 GHz, 150 MHz)
- Monitoring with Effelsberg single dish started on June 19, still ongoing. No significant variability until now. Flat spectral index suggests jet orientation towards observer
- The Rx ratio falls between the RL and RQ population, confirming a faint radio emission



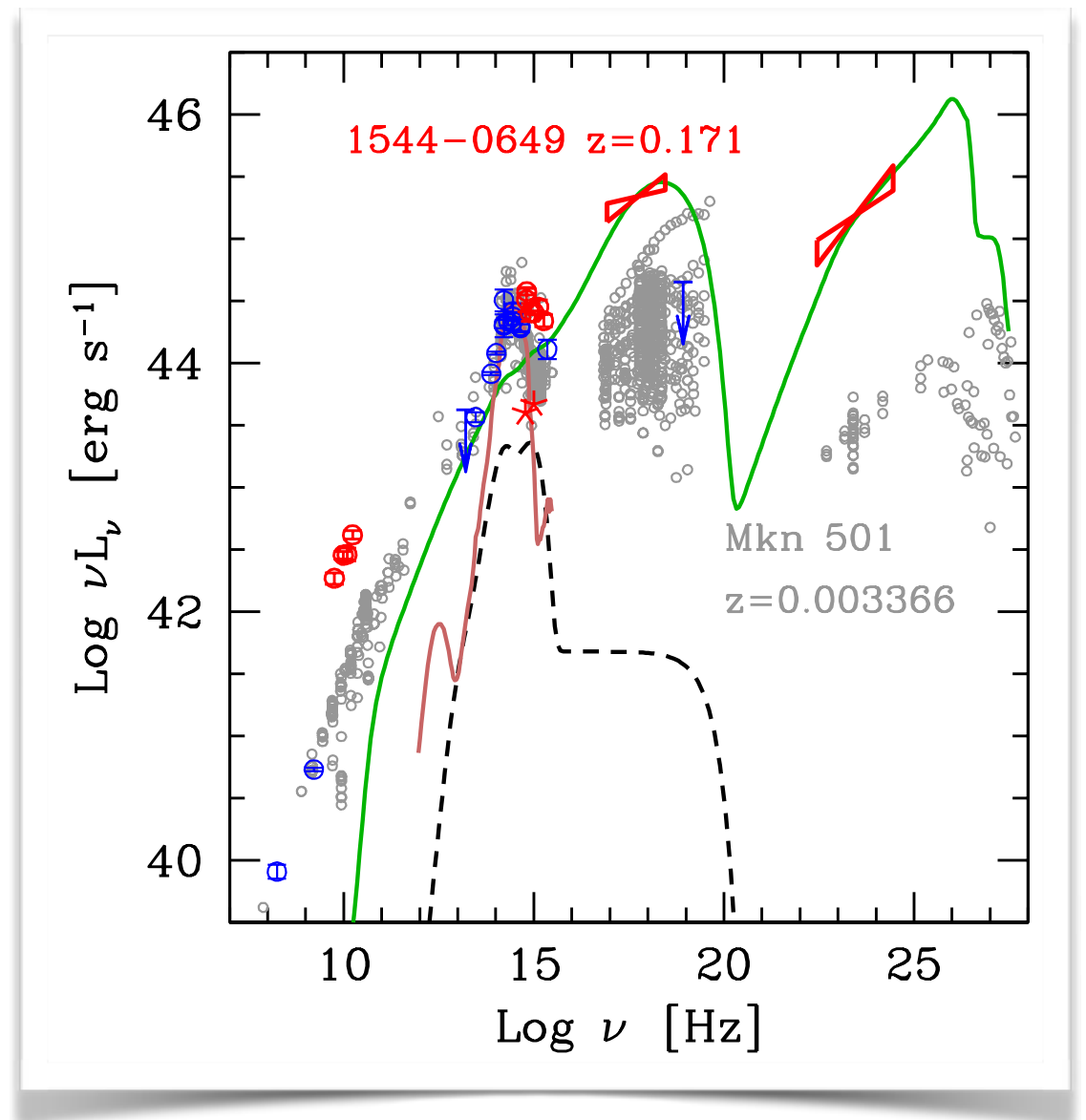
Monitoring campaign

- Optical observations with San Pedro Martir 2.1m telescope, in August 2017, showed **featureless spectrum**, suggesting BL Lac classification
- BH mass from velocity dispersion: $3.4e8 M_{\text{sun}}$
- These properties point towards a new example of radio-weak BL Lac, showing for the first time a flare in the gamma/X-ray band.



SED fitting

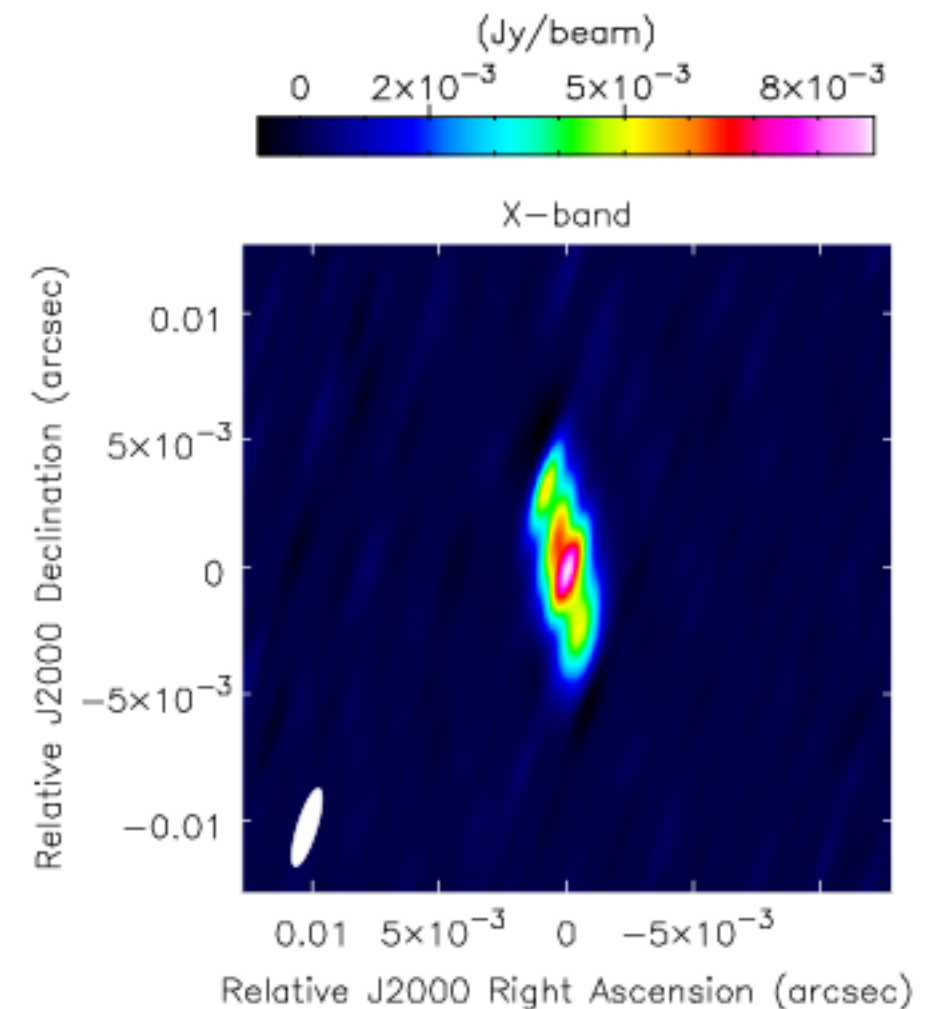
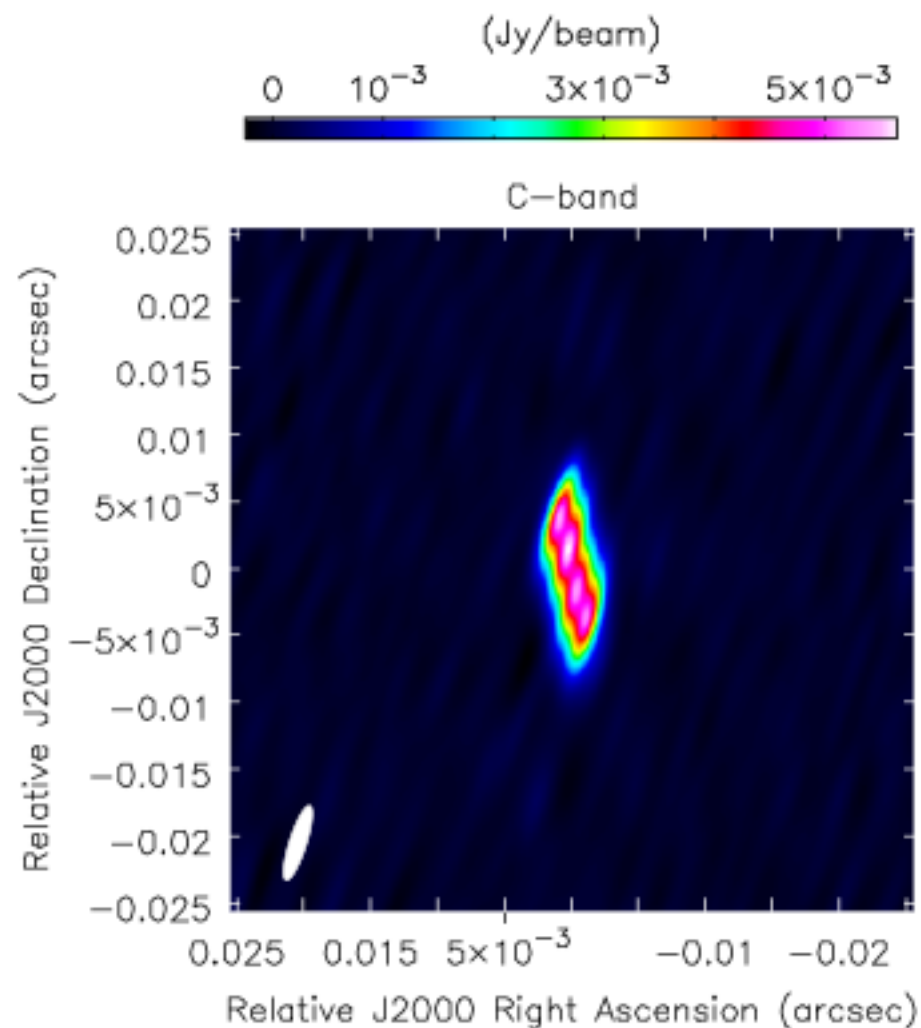
- Blue points: pre-burst, red points: post-burst. Pre-burst from ASDC database + upper limit from INTEGRAL/ISGRI first 1000 orbits.
- SED model by Ghisellini & Tavecchio 2009: red line is BL Lac host galaxy template, dashed line is AD+Torus+Corona emission
- Two-humps SED typical of Blazars, peaks position typical of low-power BL Lac
- Fitting parameters typical for low-power BL Lac (like Mkn 501), small viewing angle



z (1)	M (2)	L_d (3)	L_d/L_{Edd} (4)	R_{diss} (5)	R_{BLR} (6)	R_{torus} (7)	$P'_{\text{e,jet},45}$ (8)	B (9)	Γ (10)	θ_v (11)	δ (12)
0.171	3.4e8	8.9e-4	5e-4	16.3	81.6	372	9e-5	0.32	16.3	2	24.6

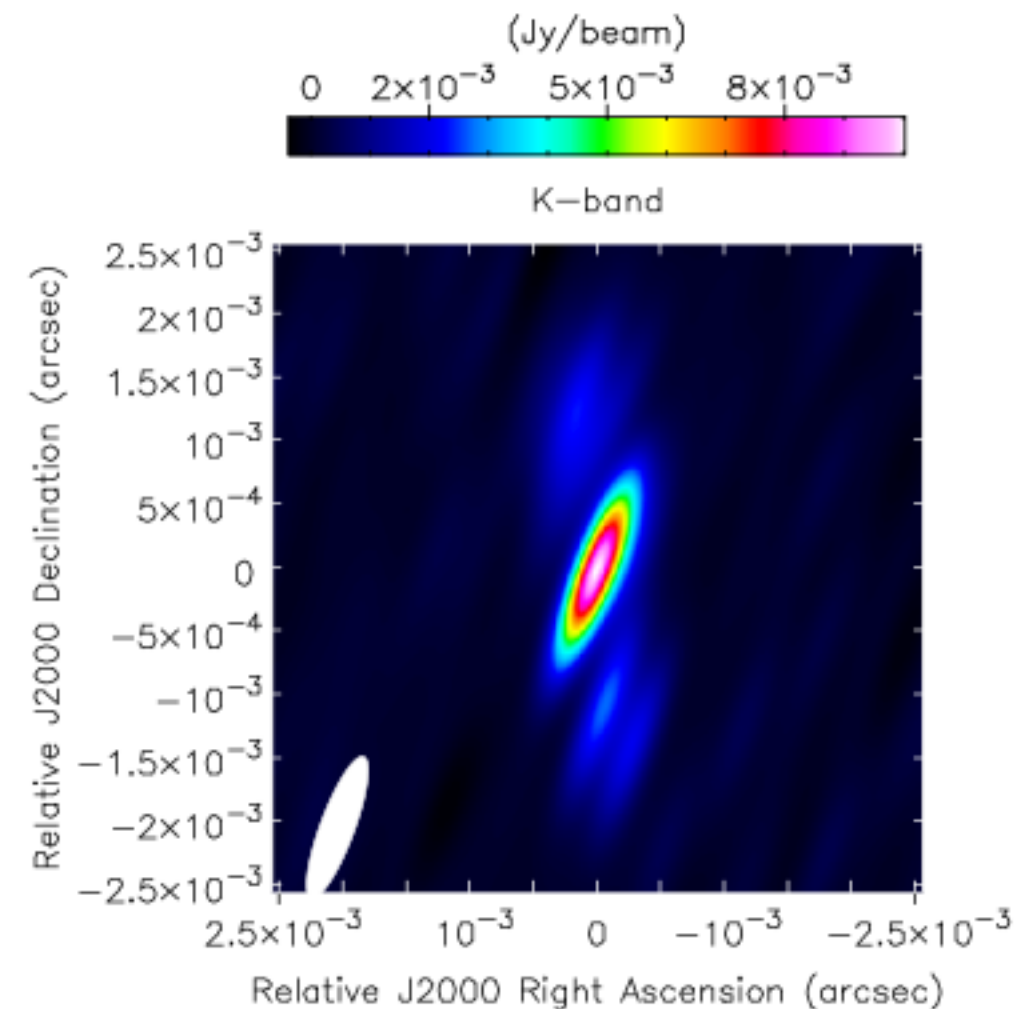
VLBA observation - the nuclear region

- Radio observation at high angular resolution (5-1 mas) performed in March 2018 with the VLBA at 5, 8, and 22 GHz
- 4 different components at 5 GHz, symmetric structure
- Further component arising at 8 GHz



VLBA observations - the nuclear region

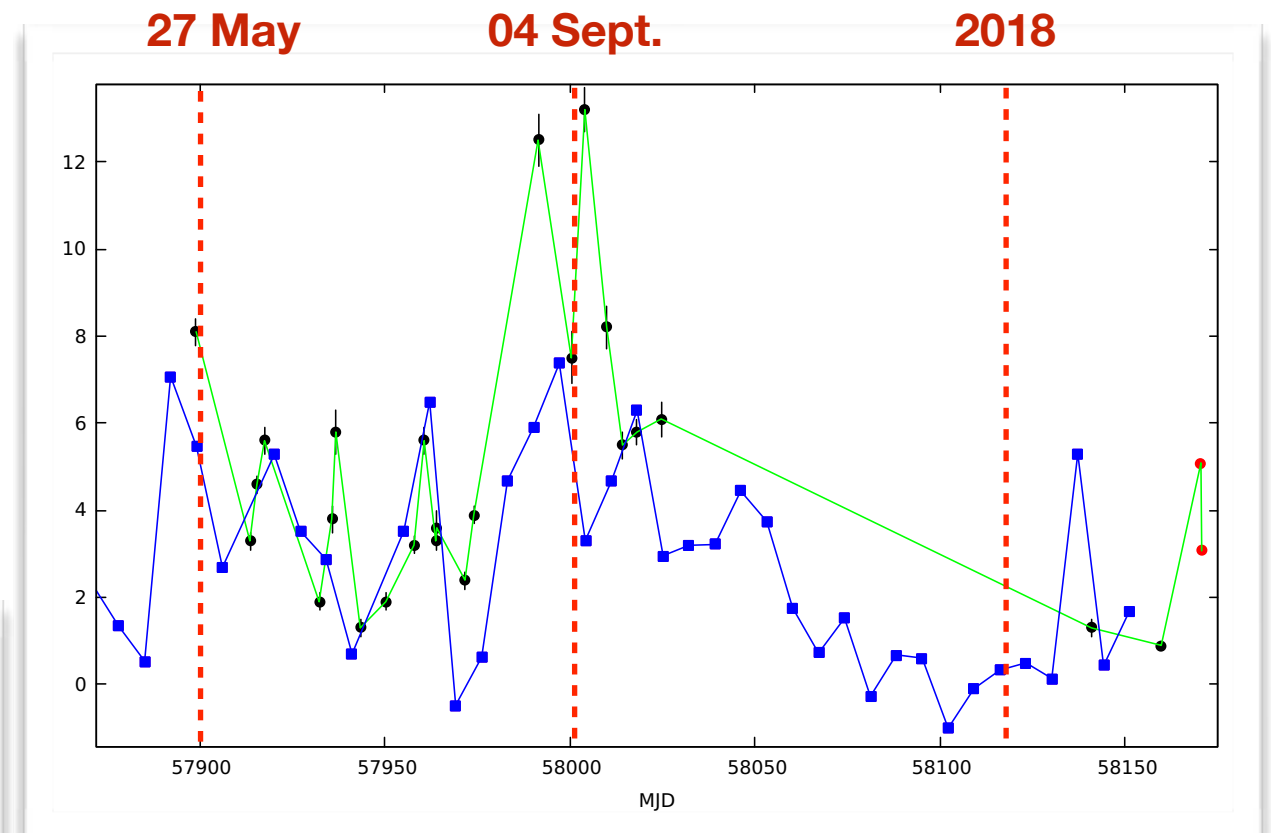
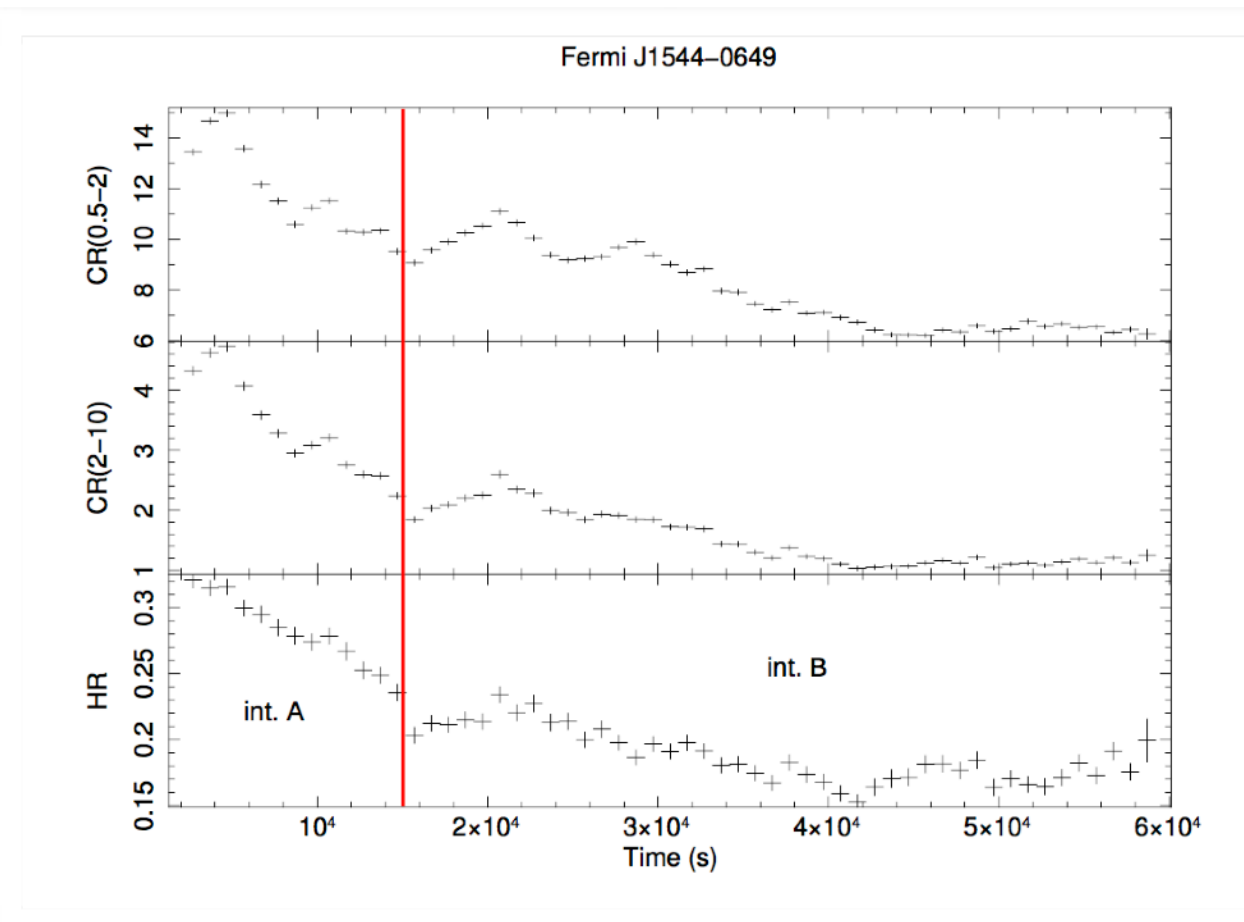
- At 22 GHz, only central component visible, the rest becomes diffuse
- Flux of 16 mJy at 8 GHz, 9 mJy at 22 GHz, none of the components shows a flat spectrum, typical of the radio core
- Possibly a new, compact component ejected after the gamma-ray event?



1 mas = 3 pc

XMM and Swift observations

- XMM/pn ToO on February 21st, 2018, 56 ks
- High variability (x10 decrease), both in flux and spectral shape
- Ongoing Swift/XRT monitoring till end of July



Green: Swift/XRT + XMM/pn (0.3-10 keV)

Blue: FERMI/LAT (0.8-300 GeV)

- Quasi-simultaneous data with XMM, NTT/EFOSC2, Loiano and VLBA obtained in March 2018 (Ursini et al. in prep; Bruni et al. in prep.)

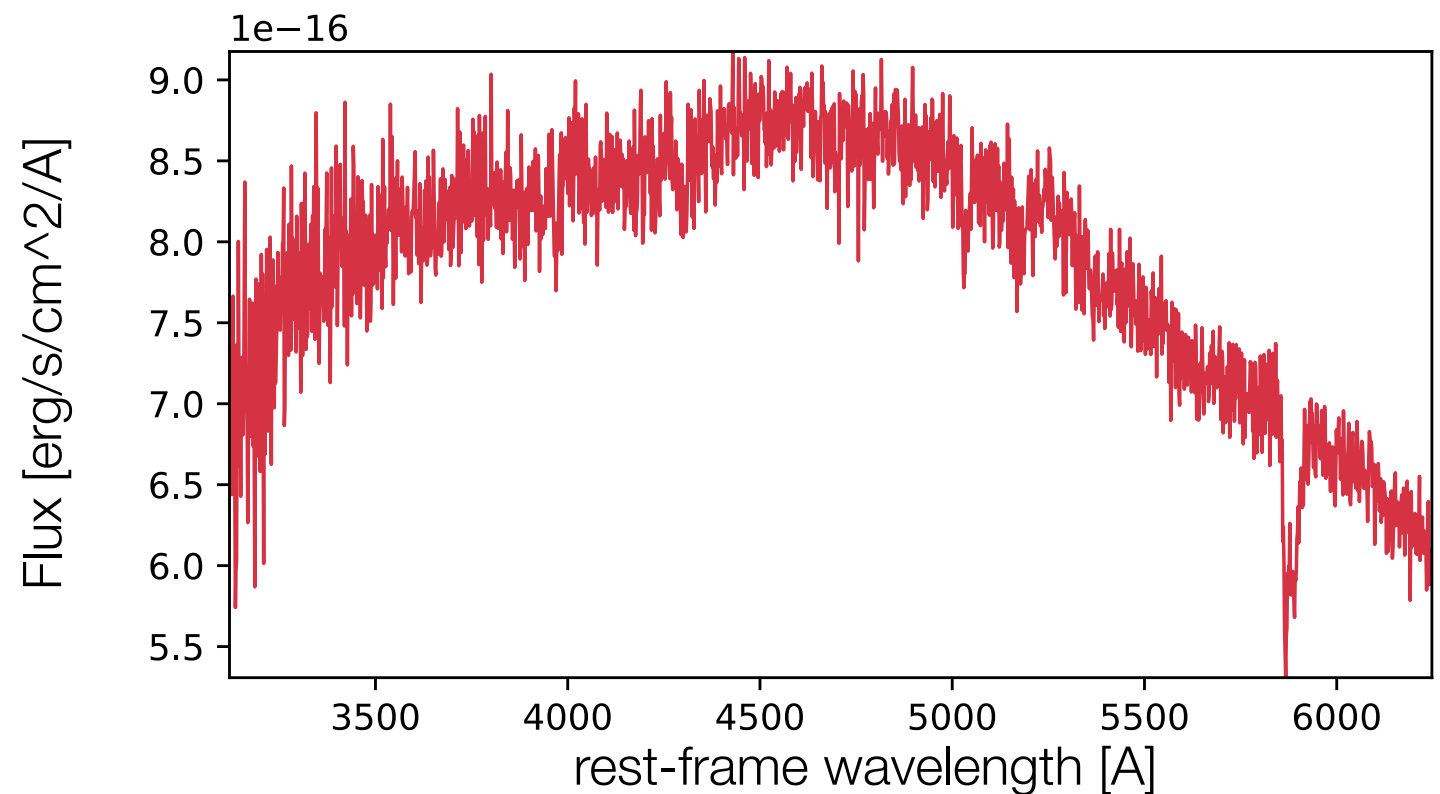
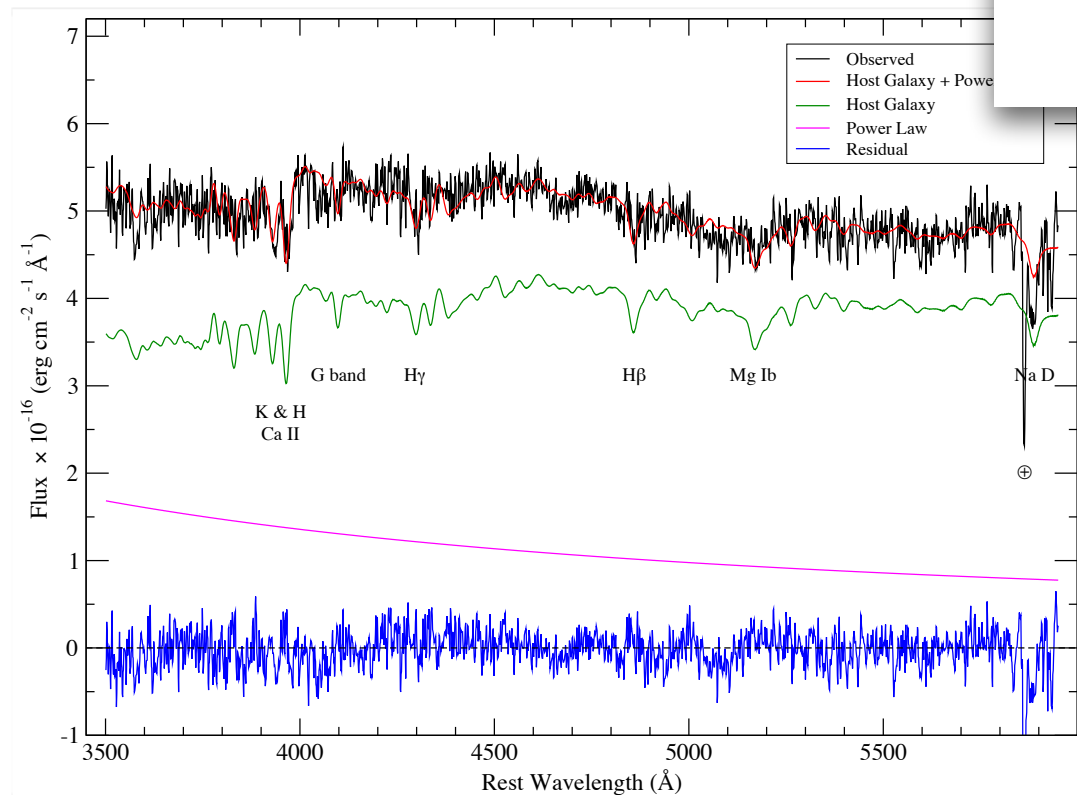
Optical monitoring, latest spectrum



April 2018



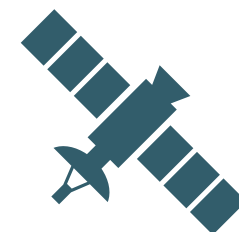
August 2017

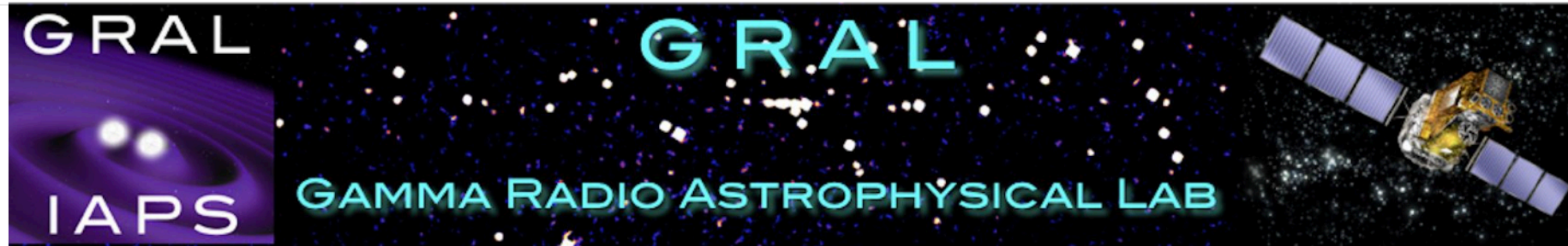


- Latest spectrum from OAGH (Cananea, Mexico) confirms featureless spectrum
- Flux increased by 50% w.r.t. August 2017
- Both optical and NIR observations ongoing till September

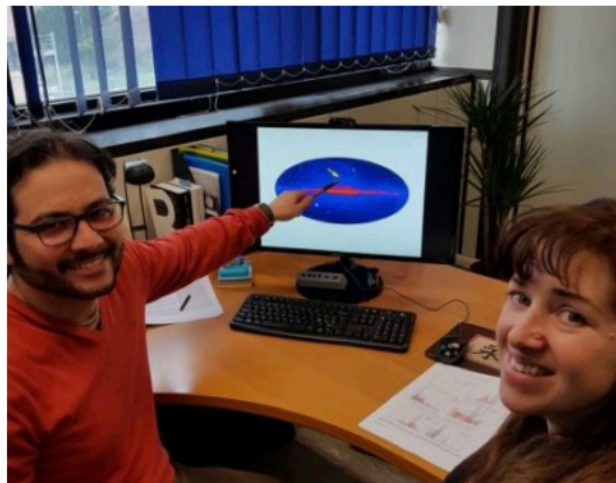
Summary

- SED and optical spectrum confirm a BL Lac nature
- Rx indicates a status at the boundaries between RL and RQ
- Overall SED typical of low-power BL Lac
- First high-energy flare from a radio-weak BL Lac
- Flare not (yet?) detected at radio frequencies
- Inefficient jet collimation? Distance between gamma-ray emission region and mm-core larger than normal?
- Keep the monitoring on....





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