Broadband emission of blazar S5 0716+714 during impressive outbursts

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Valeri M. Larionov (St. Petersburg State University, Pulkovo Observatory),
Alan Marscher (Boston University)

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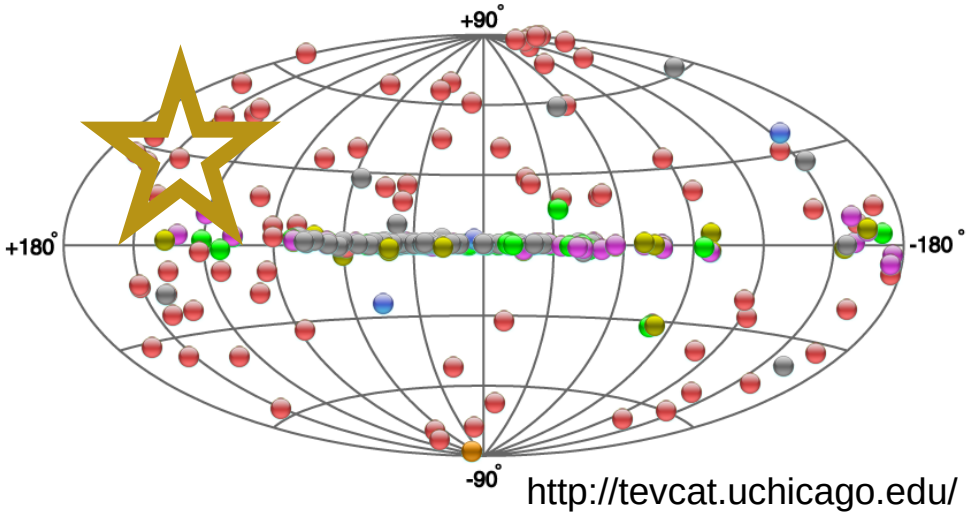

http://tevcat.uchicago.edu/

- Redshift : z = 0.31
- Category :

  Intermediate-energy peaked BL Lac (IBL)

S5 0716+714 in VHE gamma-ray

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2007/11 & 2008/04	MAGIC (mono)	H. Anderhub et al. (2009)
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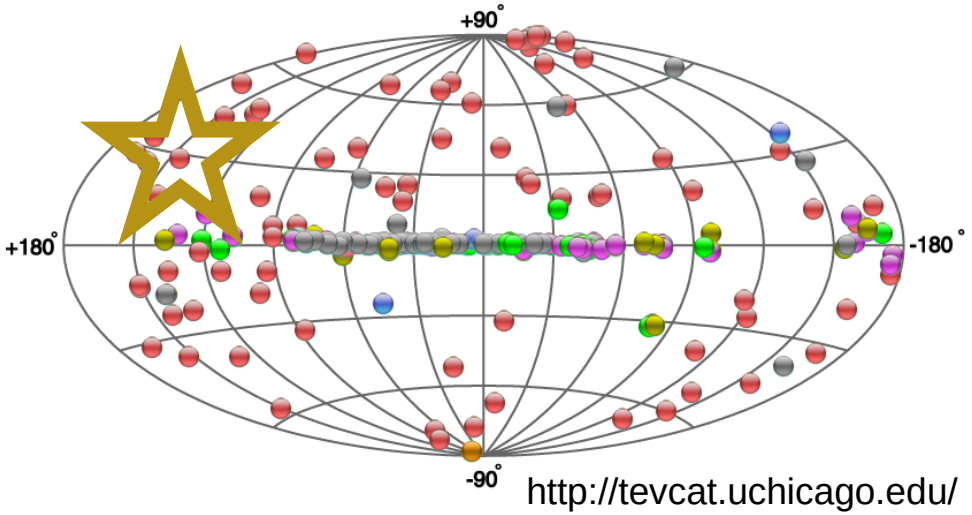
About MAGIC

- Imaging Atmospheric Cherenkov Telescopes (IACTs)
- Consists of two 17 m IACTs
- Located at 2200 m a.s.l., 28° N, 18° W
  (Canary Island of La Palma, Spain)
- Energy range : 30 GeV – 100 TeV

Blazar S5 0716+714



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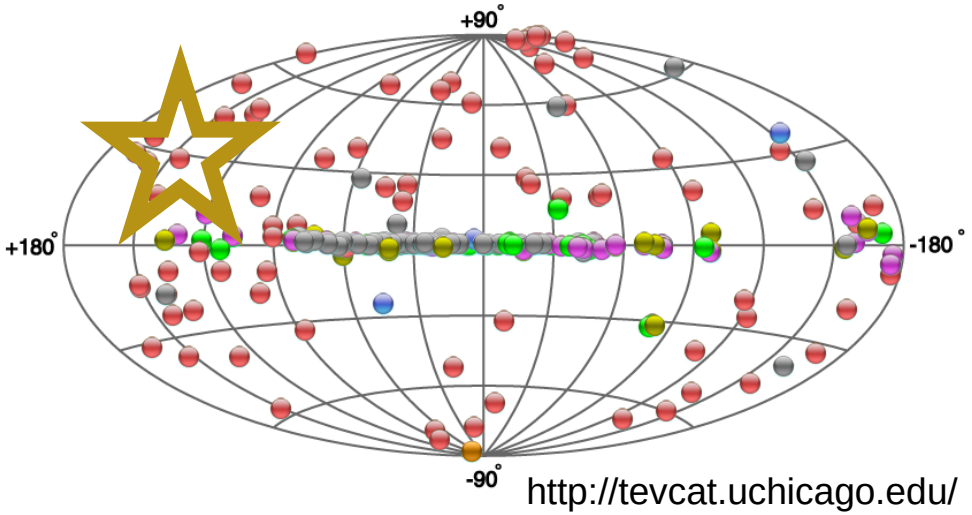

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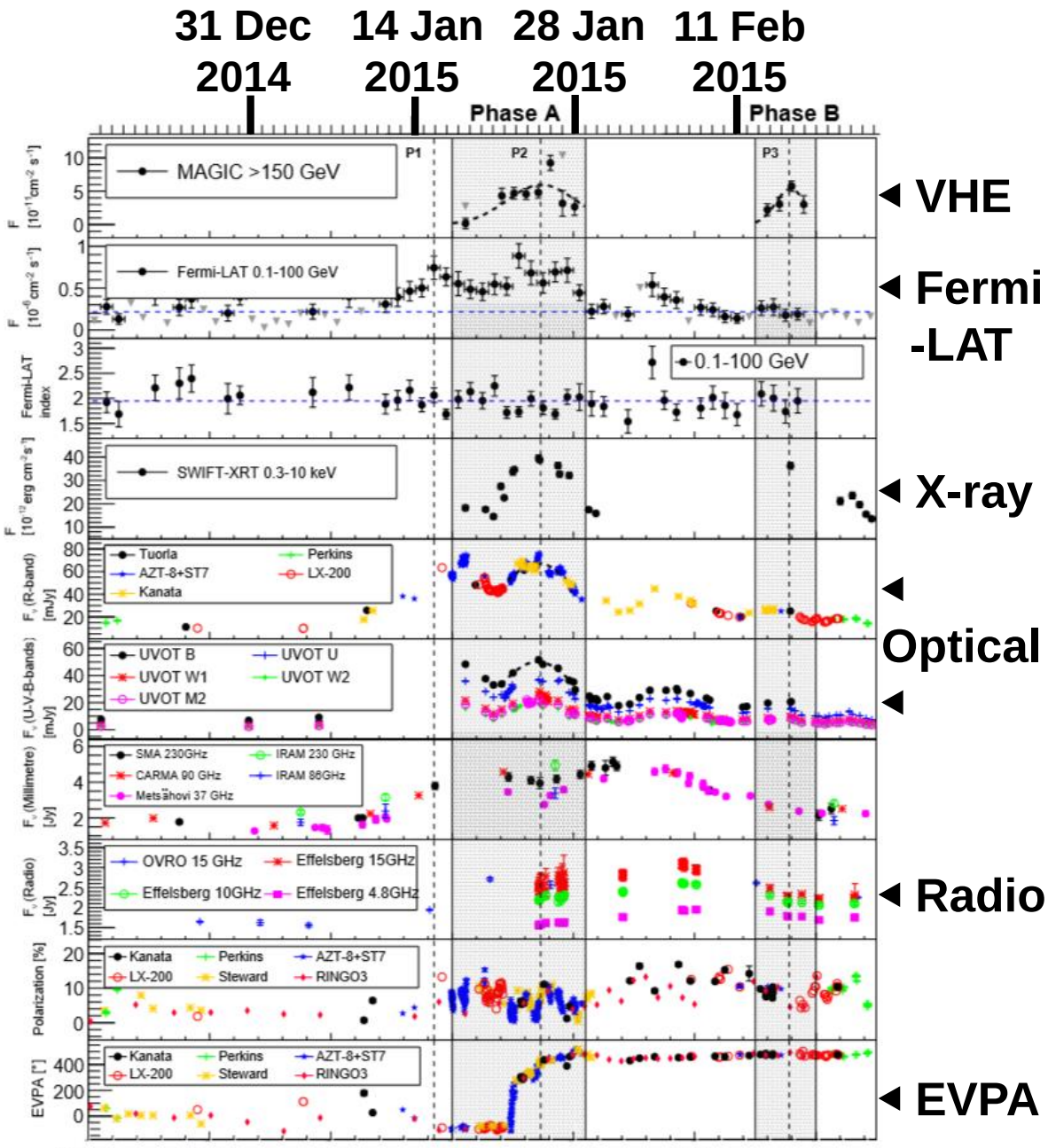
Flare in 2015 : Multi-Wavelength Light Curve

Multi-wavelength LC from radio to VHE obtained

Phase A (18–27 Jan. 2015)
- ◆ Strong flaring activity from radio to VHE
- ◆ Rapid rotation of EVPA

Phase B (12-17 Feb. 2015)
- ◆ flare only in VHE and X-ray



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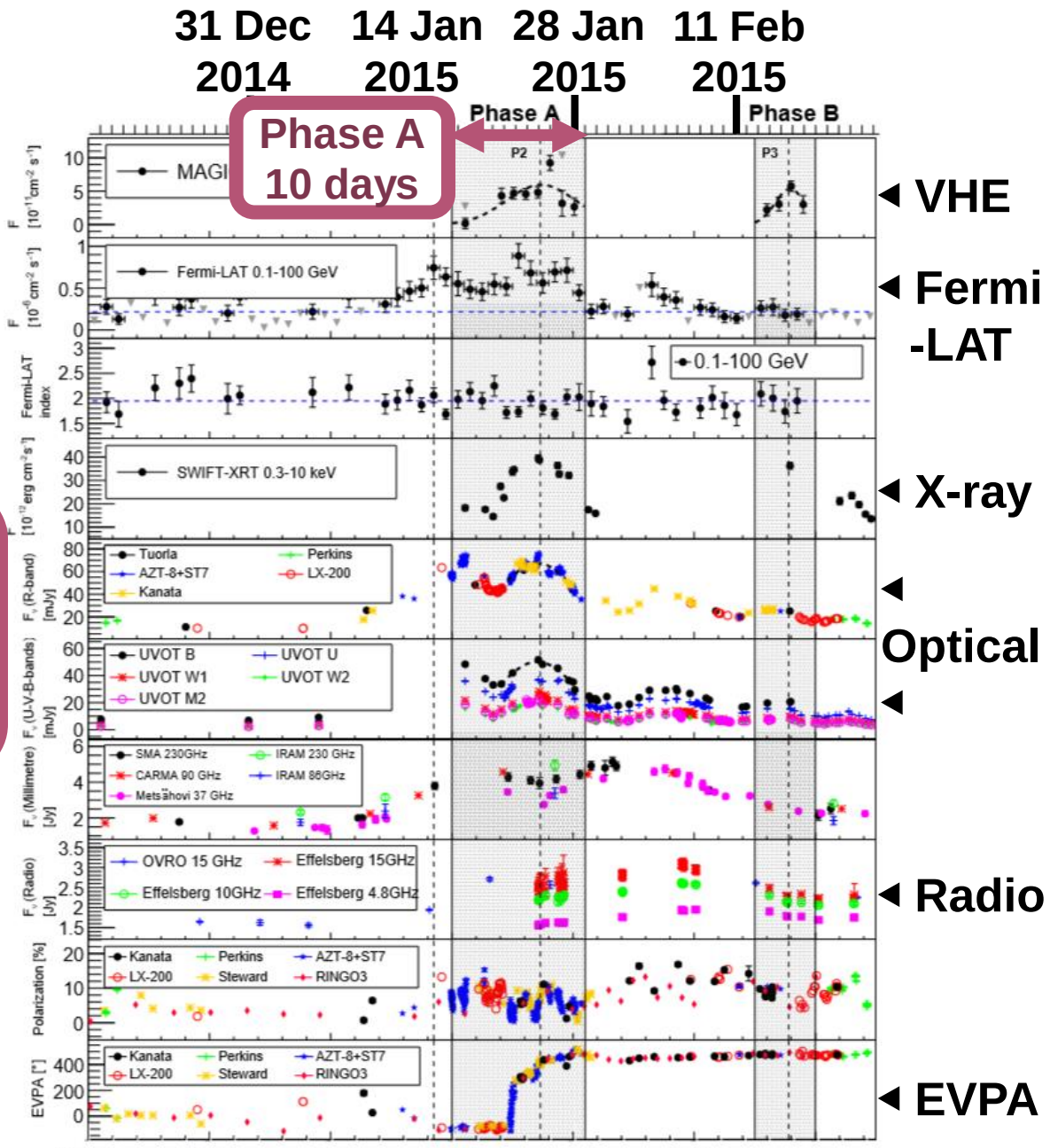

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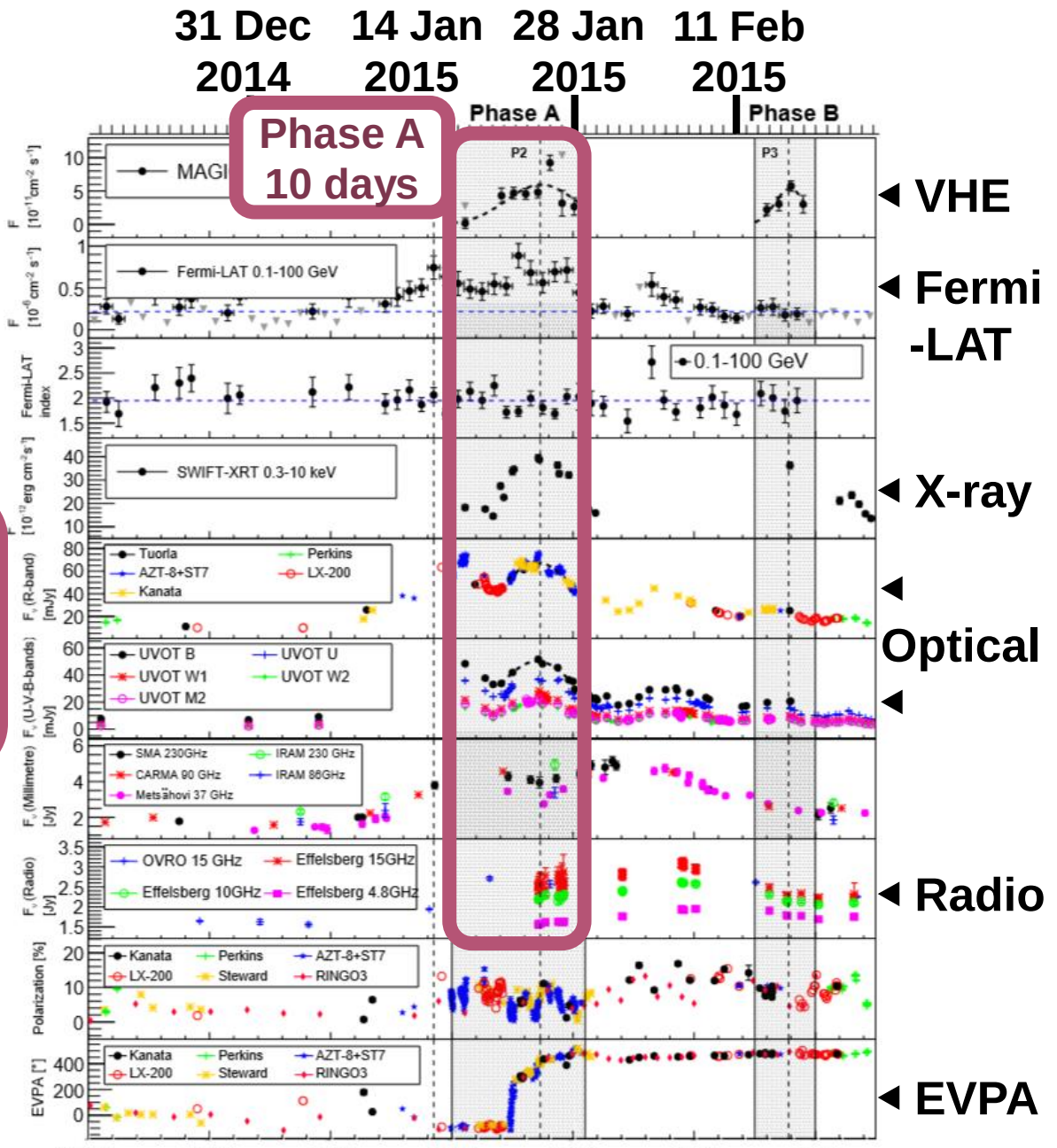

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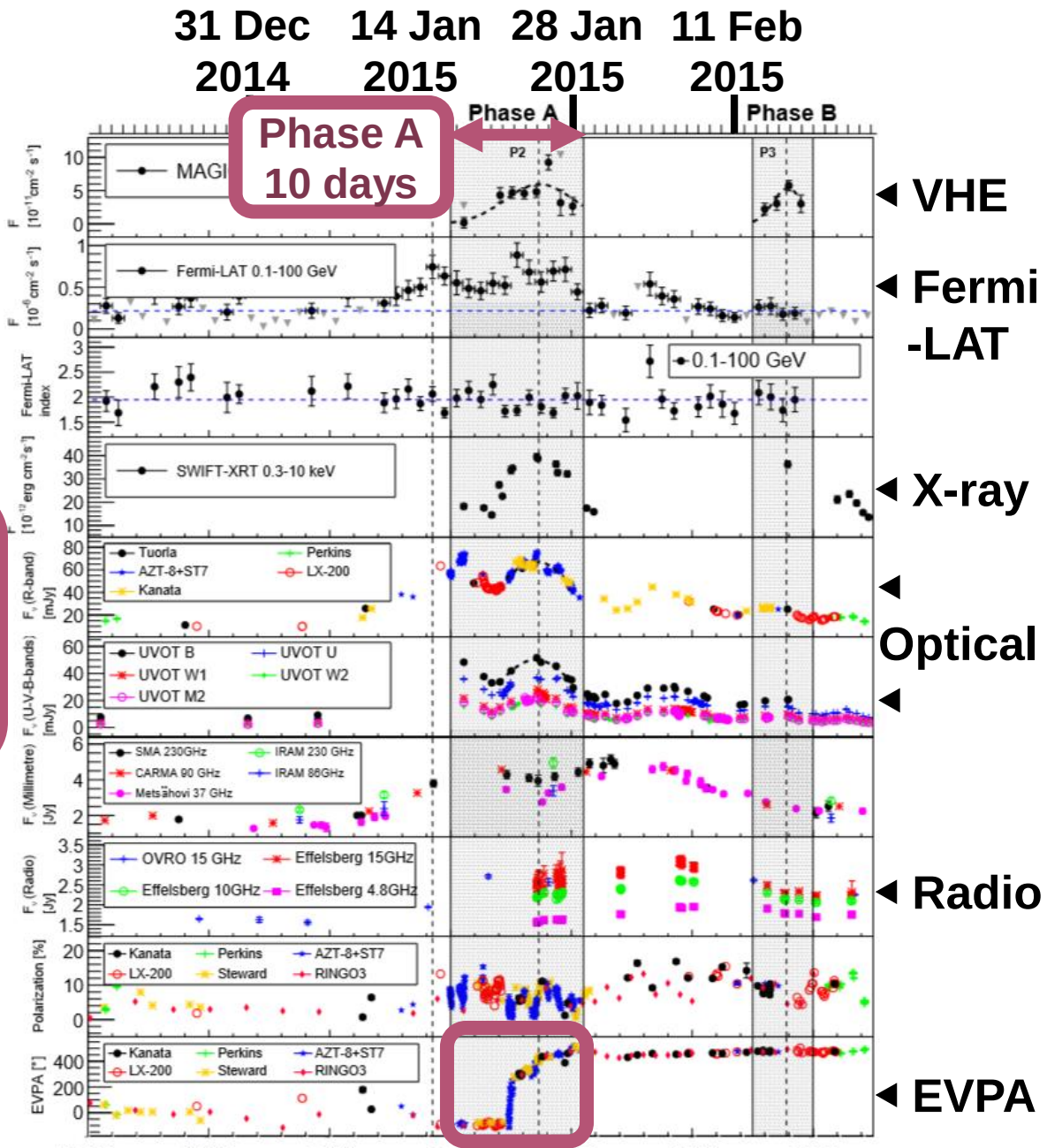

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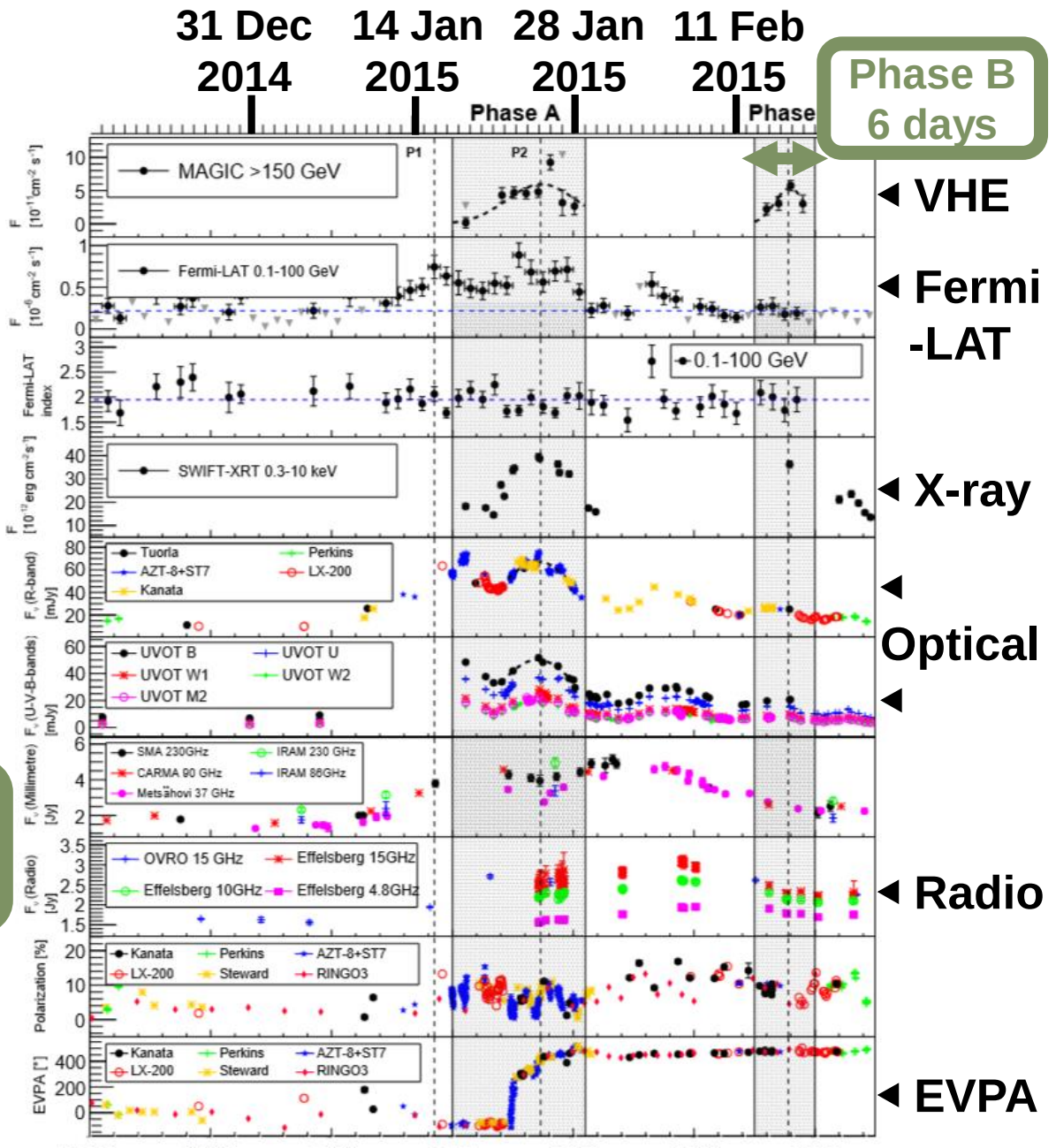

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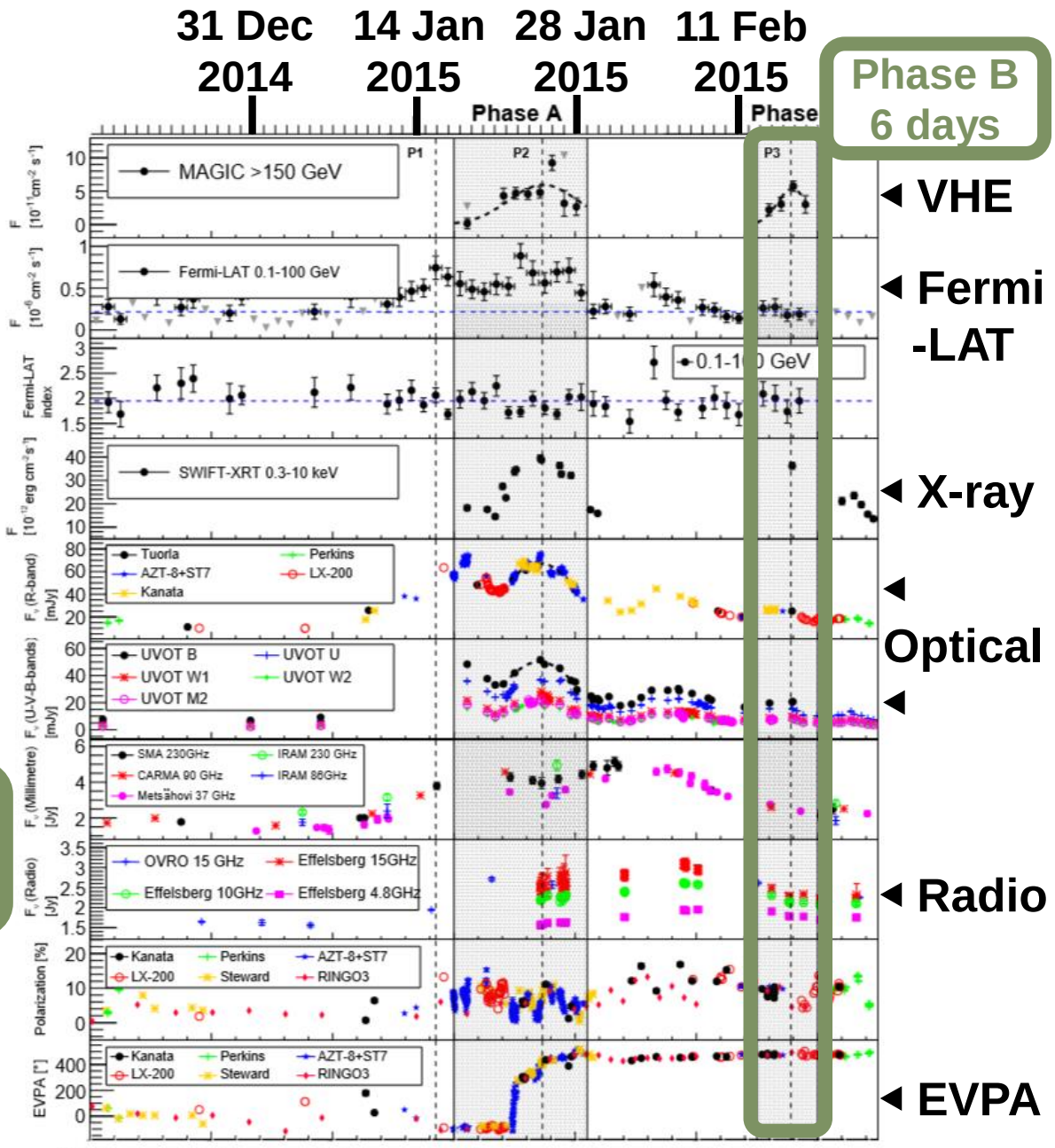
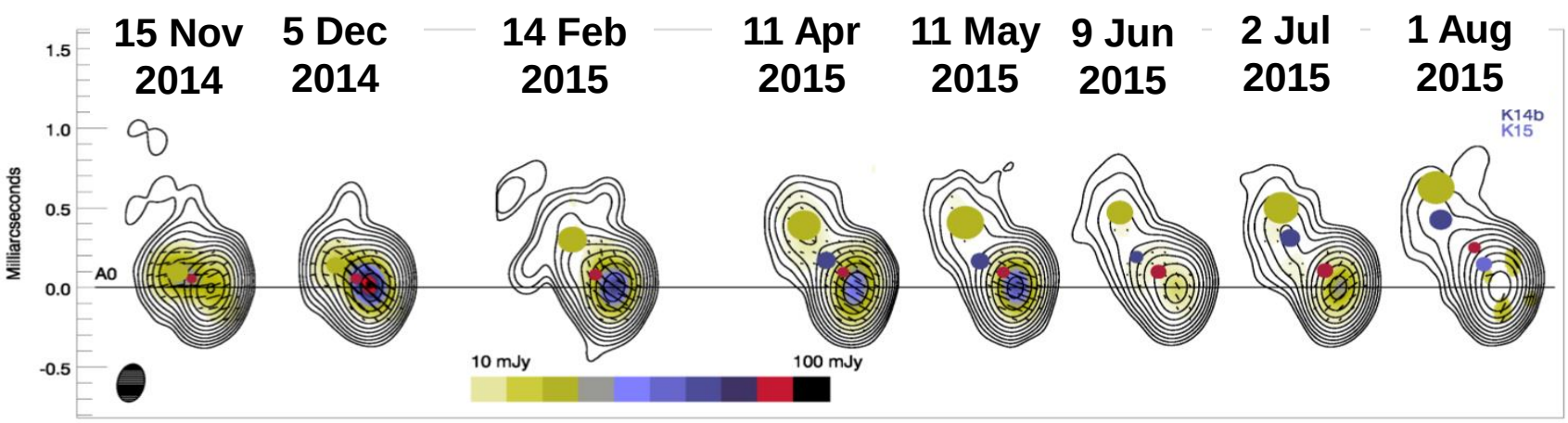
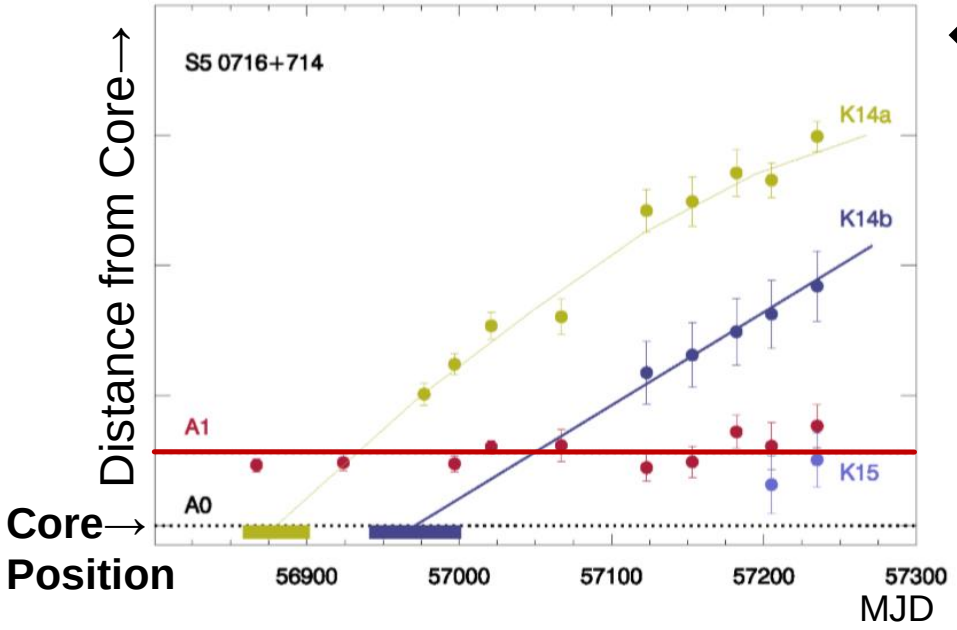


Flare in 2015 : VLBI (43 GHz)





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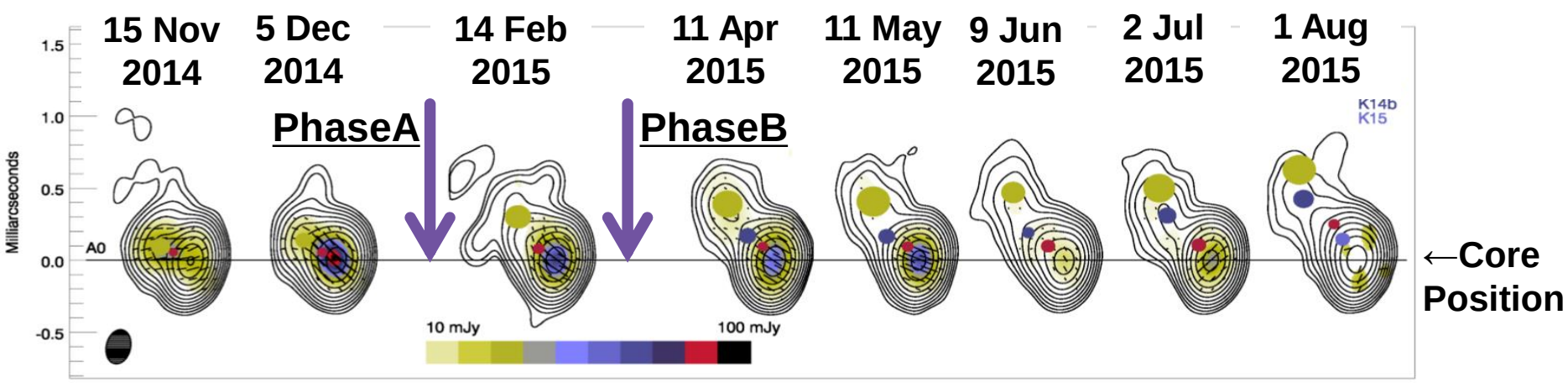

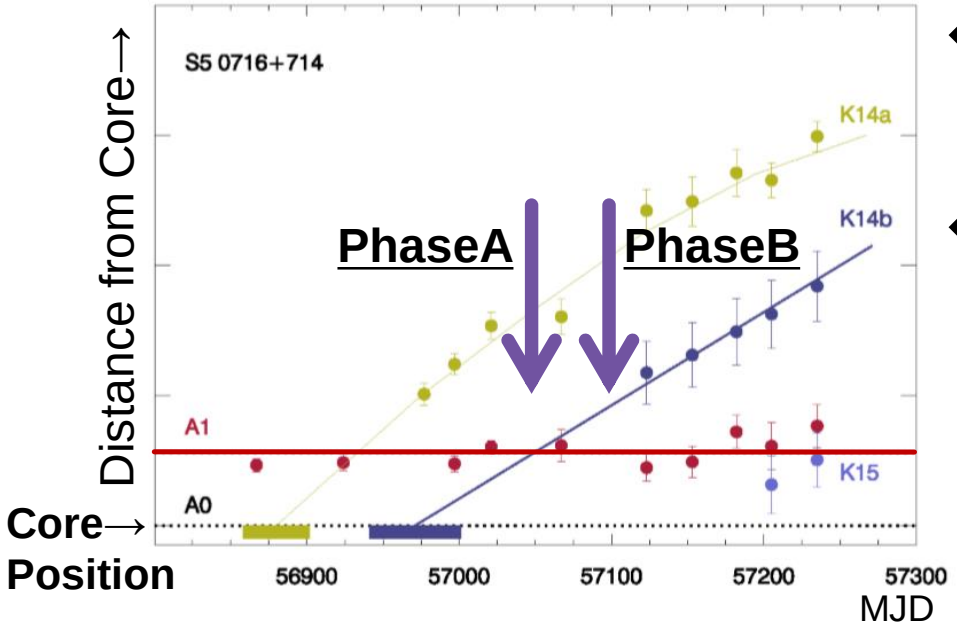

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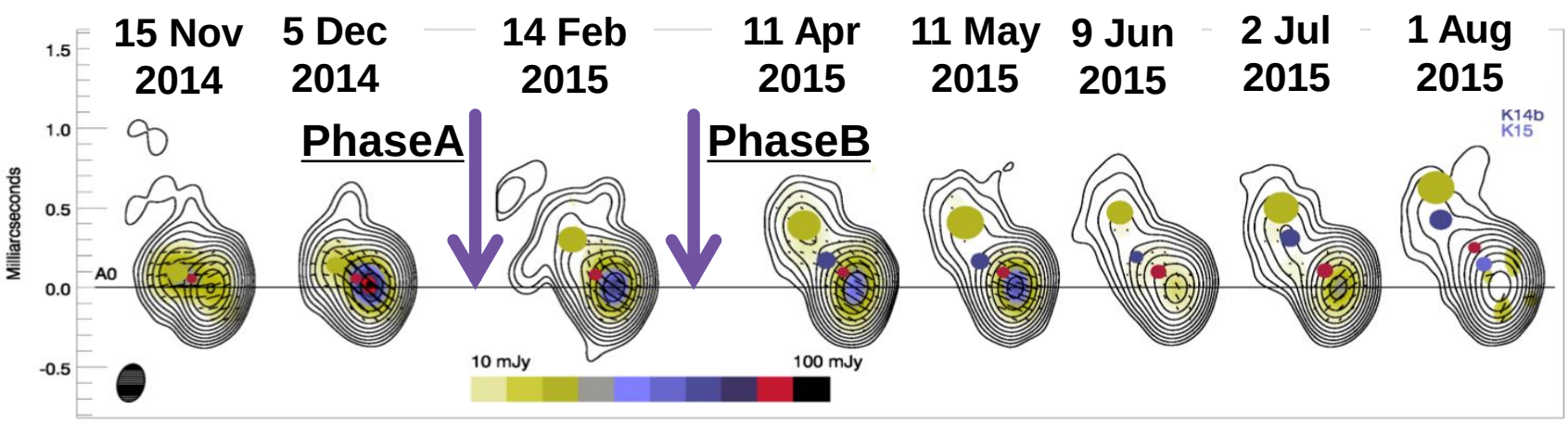

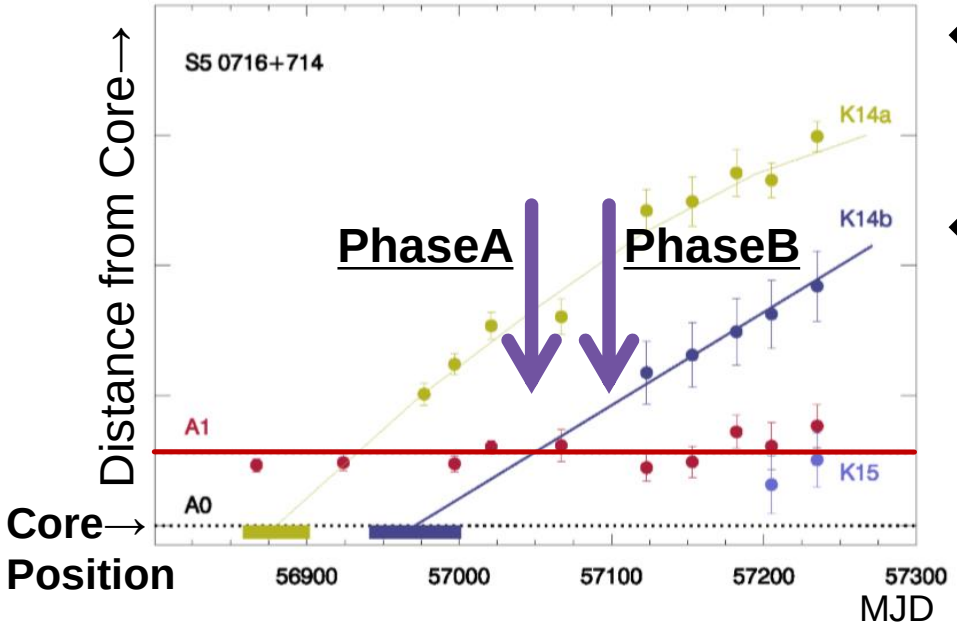

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Flares could have been caused when knot● enters and exits feature●

Flare in 2015 : Multi-wavelength SED

◆Full SED from radio to VHE was obtained for the first time

×Simple One-zone SSC model cannot explain SED

✓ Two zone model reproduces the SEDs for Phase A and B

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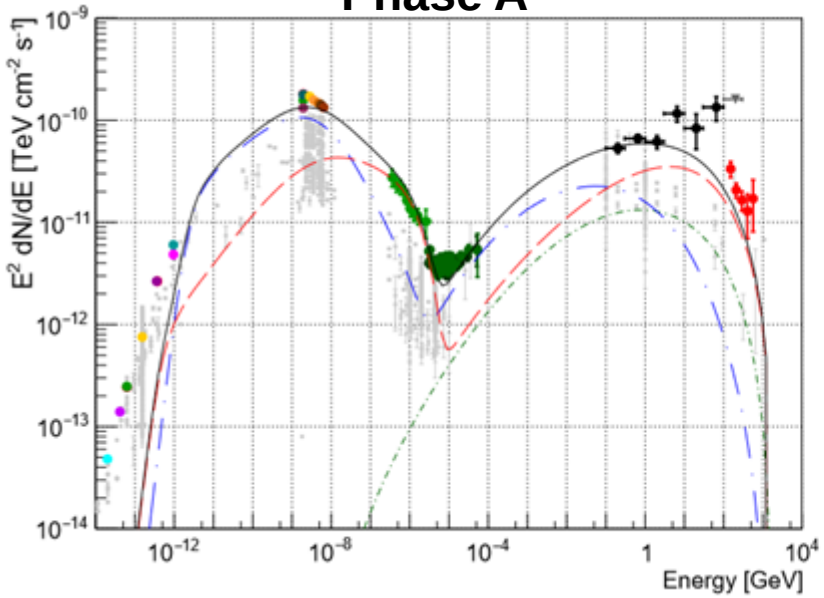

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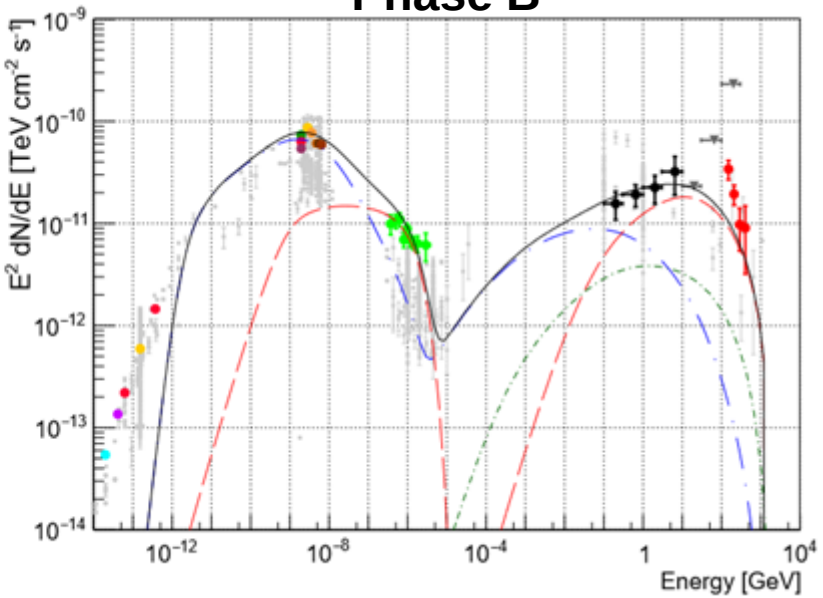

— **Blob1(Syn+SSC)**
— **Blob2(Syn+SSC)**
— **Supplying seed photons for each other**
— **Total**

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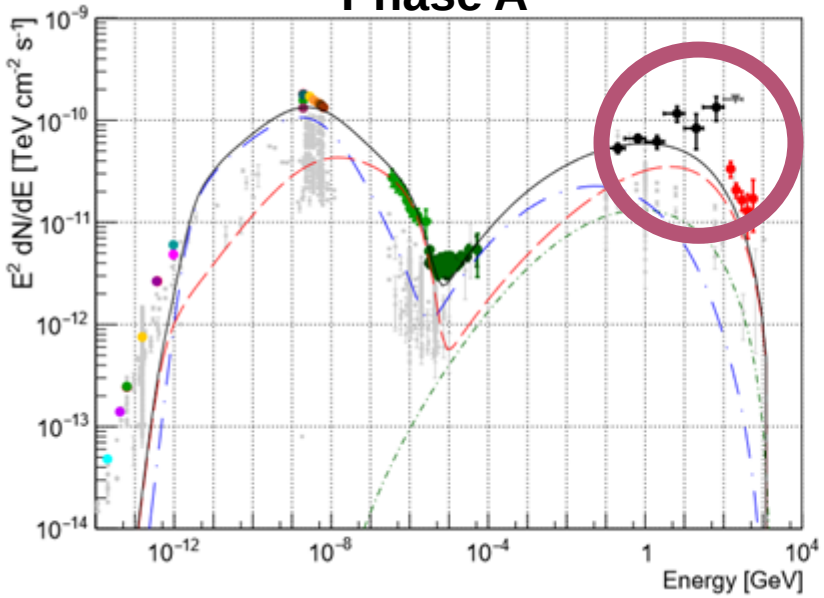
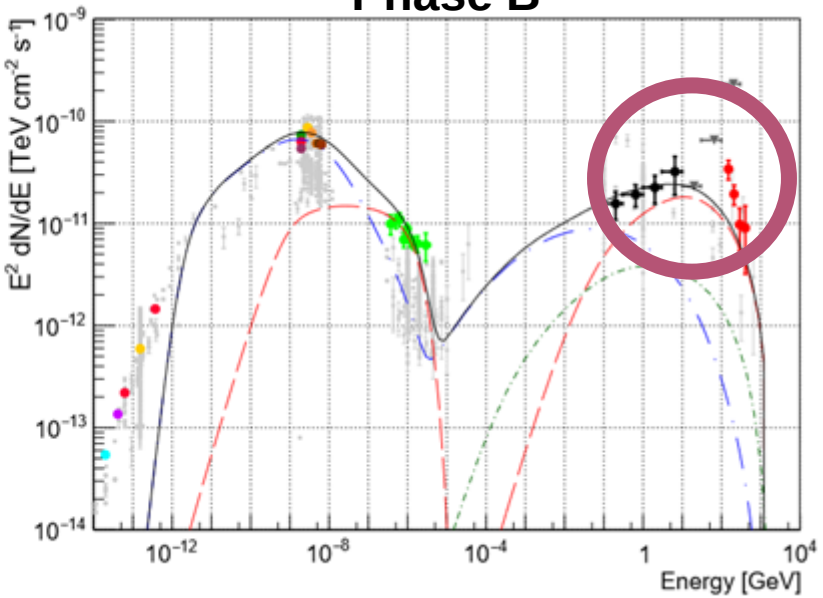


Phase B



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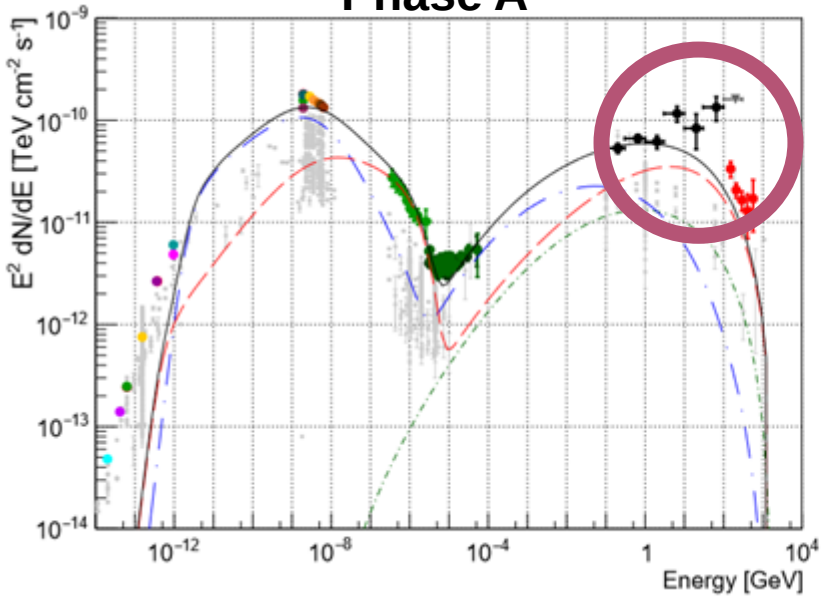

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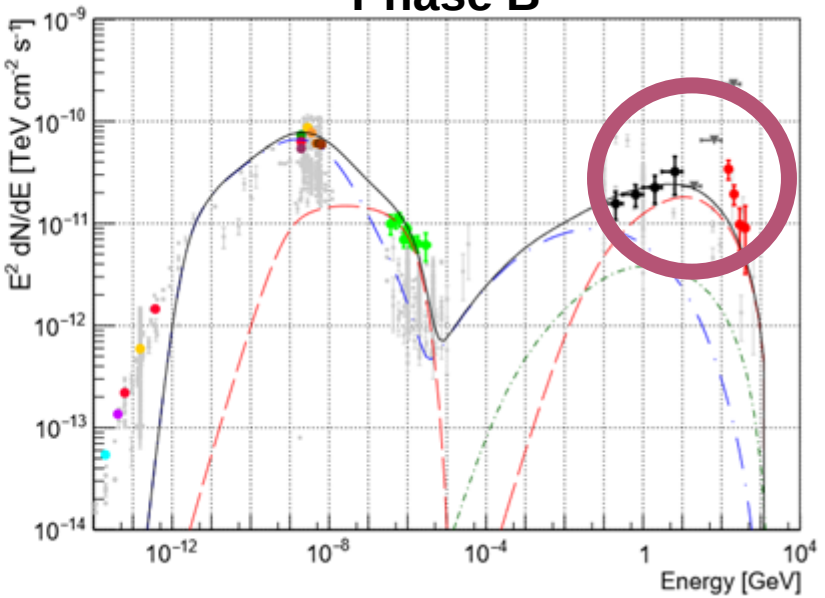

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Other models could be tested to better fit the HE bump (e.g. TEMZ model)

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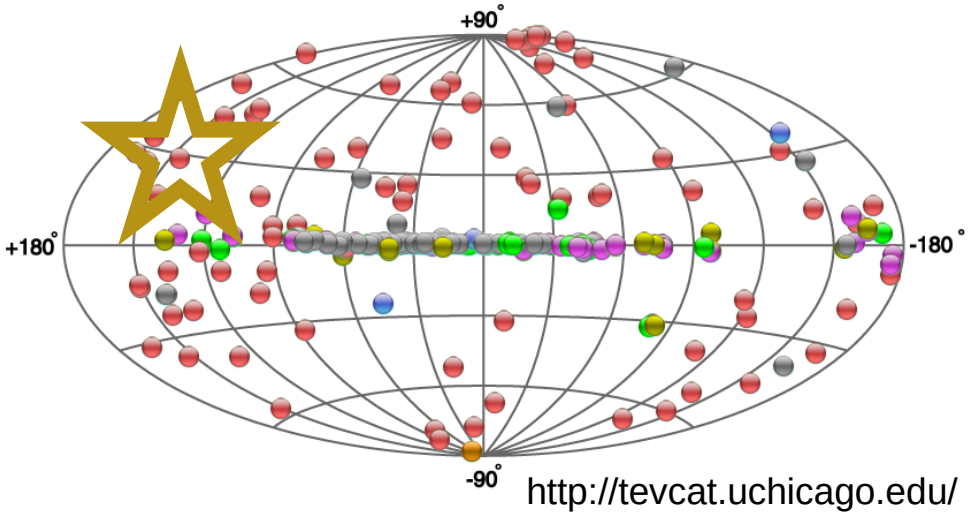

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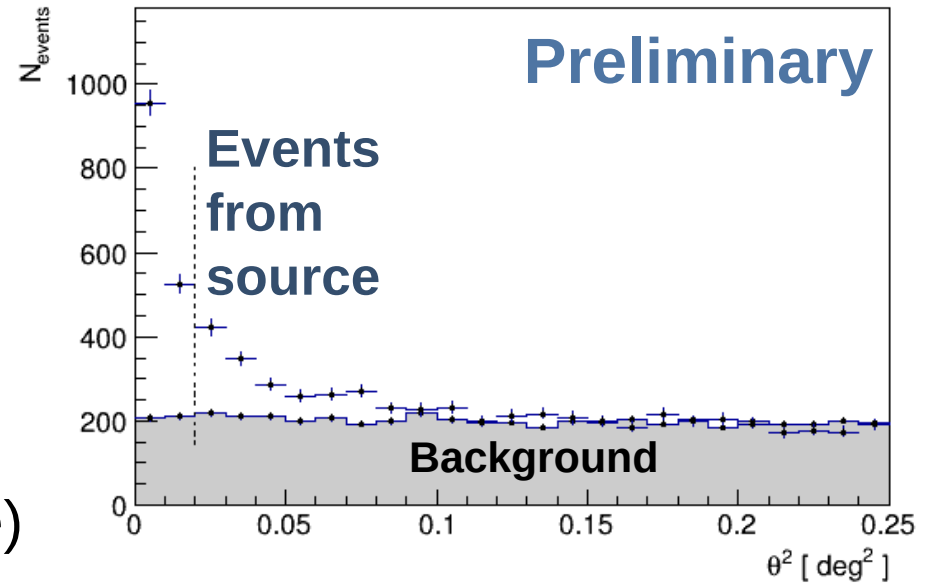
New Flare in 2017

- Triggered by Fermi-LAT hard spectrum
- Observed in 28-29 Dec. 2017 (for 2 days)
- Strong signal in short time

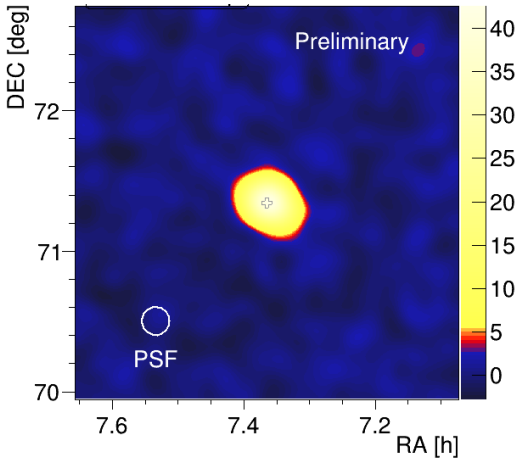
(~6 times stronger than 2015 flare)

θ^2 plots for 28th Dec.

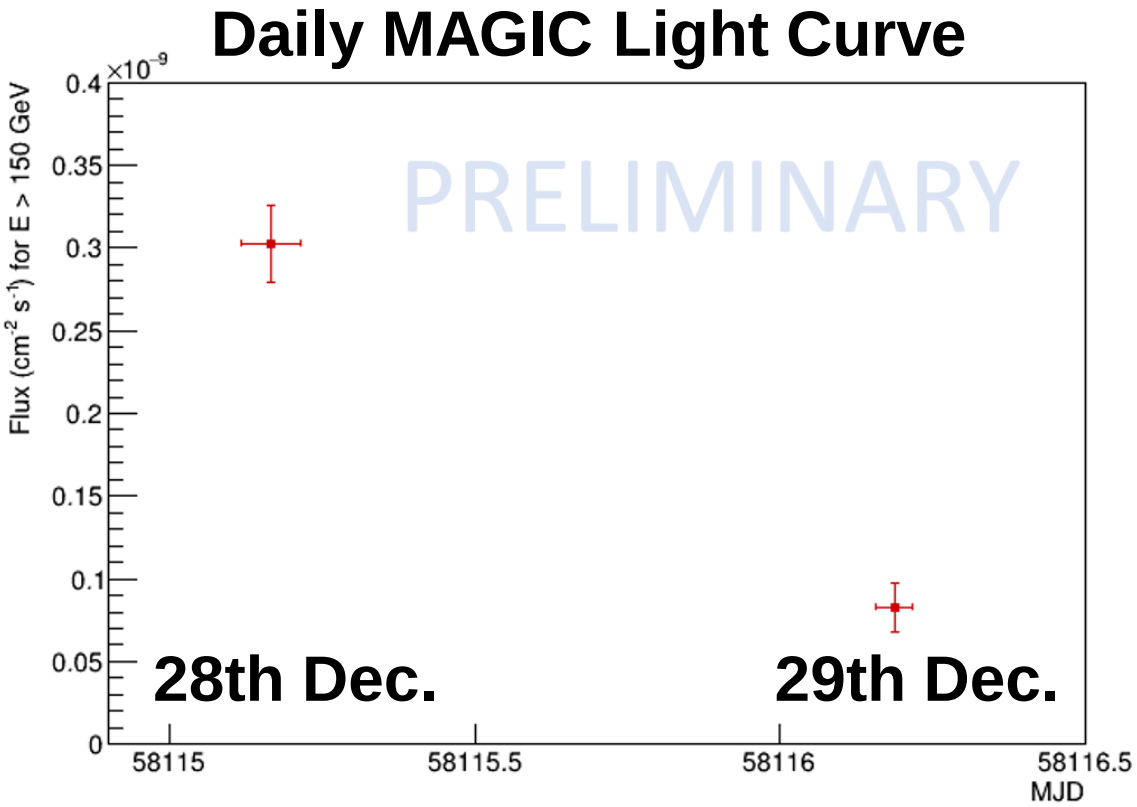


	Effective time	Significance
28 Dec. 2017	2.18 h	32.92 σ
29 Dec. 2017	1.63 h	8.33 σ
Total	3.81 h	31.43 σ

cf. 2015 flare : 18.9σ for 17.46 h



New Flare in 2017 : MAGIC Light Curve



- **Intra-night activity** has been seen for the first time for this source
  (Analysis to produce a more detailed LC is under way)
- Multi-wavelength data is being collected

Summary

- Full SED was obtained for the first time
- Very fast rotation of EVPA was seen with the VHE flare
- VLBI sequence indicates that superluminal knots pass through a stationary emission feature
- One-zone model cannot reproduce the SED, while two-zone model with zones interacting with each other works better
- VLBI sequence, LC, EVPA rotation and SED are qualitatively consistent with a scenario in which the VHE gamma-ray emission is found originating in the entrance and exit of a superluminal knot in and out of a recollimation shock in the inner jet
- Intra-night activity has been seen for the first time during the new flare in 2017

Thank you for your attention