FSRQ or BL Lac? MWL view of the transitional blazar OT081

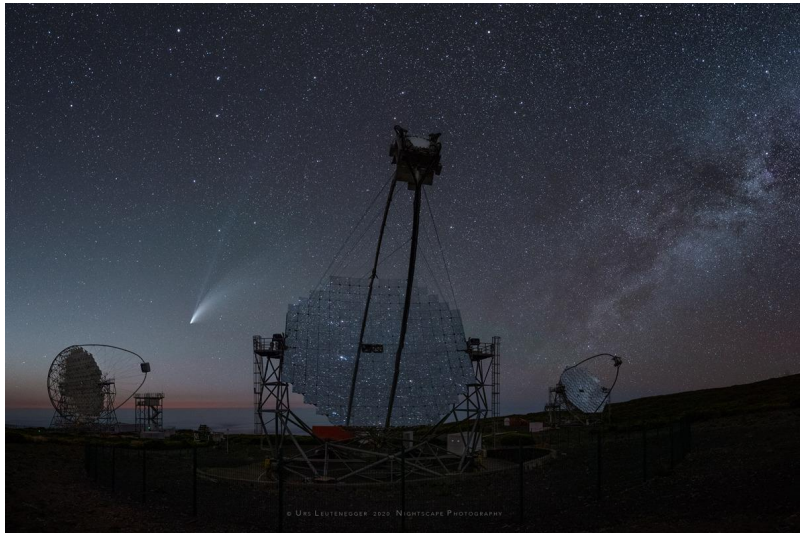

Image Credit: Urs Leutenegger (@urs.leutenegger)

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On behalf of the MAGIC, H.E.S.S. and *Fermi*-LAT collaborations

A multi collaboration and multiwavelength team

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H.E.S.S. : M. Seglar-Arroyo*, David Sanchez*

Modeling: Fabrizio Tavecchio, Matteo Cerruti, Hubing Xiao

Many MWL collaborators: I. Agudo, S. Ciprini, V. Fallah Ramazani, A. Esteban Gutierrez, T. Hovatta, H. Jermak, S. Jorstad, E. N. Kopatskaya, A. Lähteenmäki, V. M. Larionov, L.V. Larionova, A. Marscher, D.A. Morozova, M. Pahljina, M. Tornikoski, I. Troitsky, F. Verrecchia, Z. R. Weaver, W. Zheng

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Summary

- OT 081 (a.k.a. PKS 1749+096) is a blazar located at z=0.322
- The discovery of VHE γ-ray emission happened during a very bright flare triggered by *Fermi*-LAT and observed by many instruments simultaneously in July 2016.
- In a paper in preparation, we present the first broadband study of the source which includes VHE gamma-ray data, taken by MAGIC and H.E.S.S. arrays.

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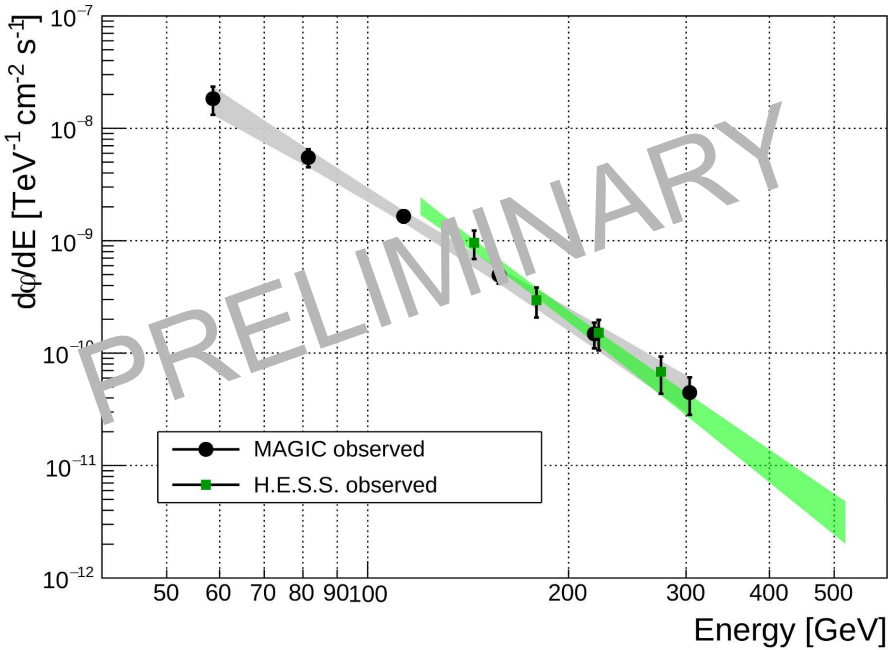
VHE spectra during the flare

MAGIC and H.E.S.S.

- **VHE flare: 22-24th July**

Exp.	T_{obs} [MJD]	T_{eff} [hr]	E_{th} [GeV]	E_{dec} [GeV]
MAGIC	57593	1.64	57	125
H.E.S.S.	57591-57593	3.1	119	173



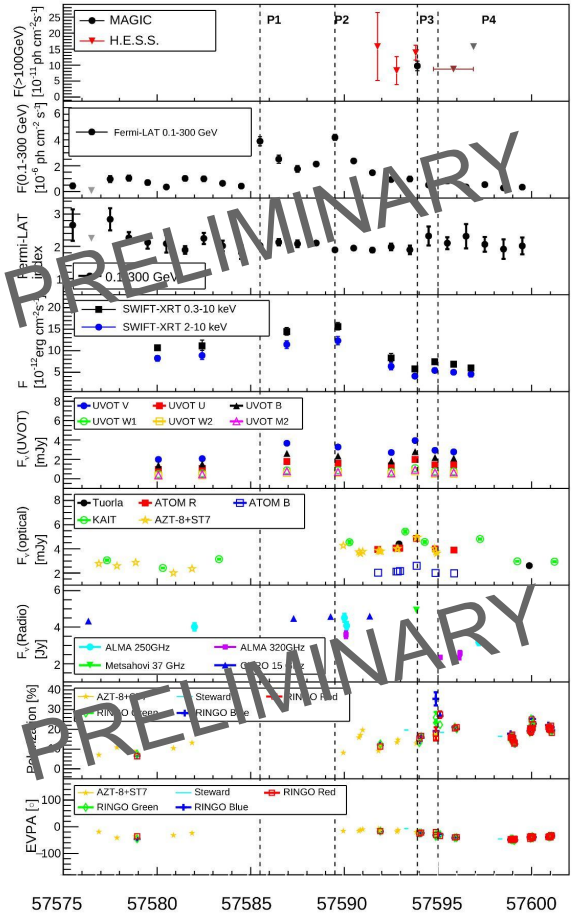
MWL Light Curves

We selected four states of activity

indicated as P1, P2, P3 and P4

-A rich dataset

- P1 indicates a high state in *Fermi*
- P2 high state in *Fermi*-LAT and Swift-XRT
- P3 VHE gamma-ray detection by MAGIC
- P4 low state apart from some optical activity



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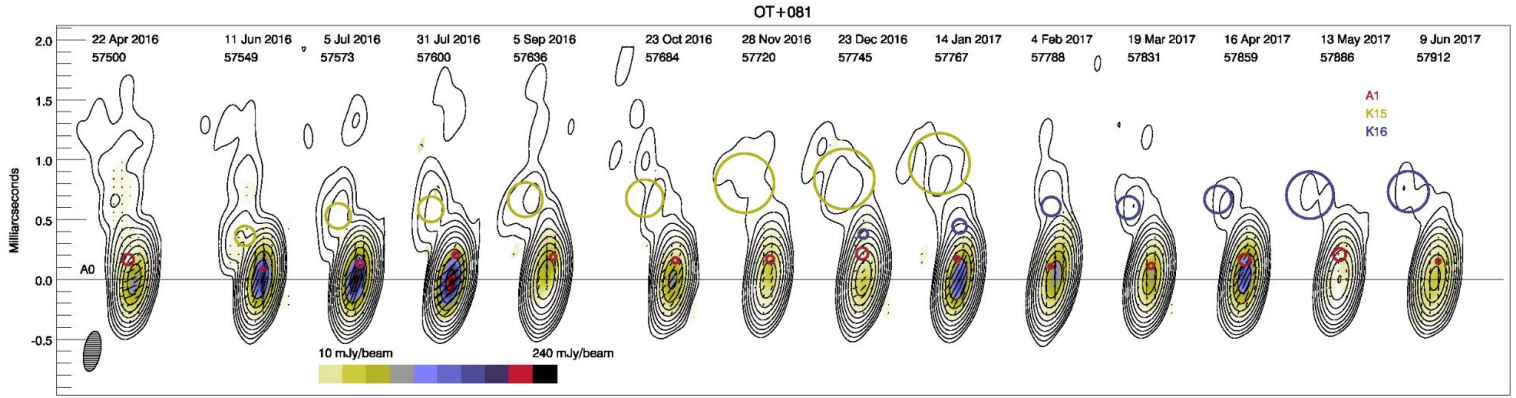
VLBA study of the jet



- parsec-scale jet of OT 081 is strongly core-dominated at 43 GHz
- the very compact VLBI core, A0, is located at the southern end of the jet and likely a stationary physical structure in the jet
- a quasi-stationary feature located 0.14±0.04 mas 12 downstream of the core is detected at all 23 epochs
- two superluminal knots, K15 and K16 were detected: their interaction with A0 and A1 could be associated to the gamma-ray flares

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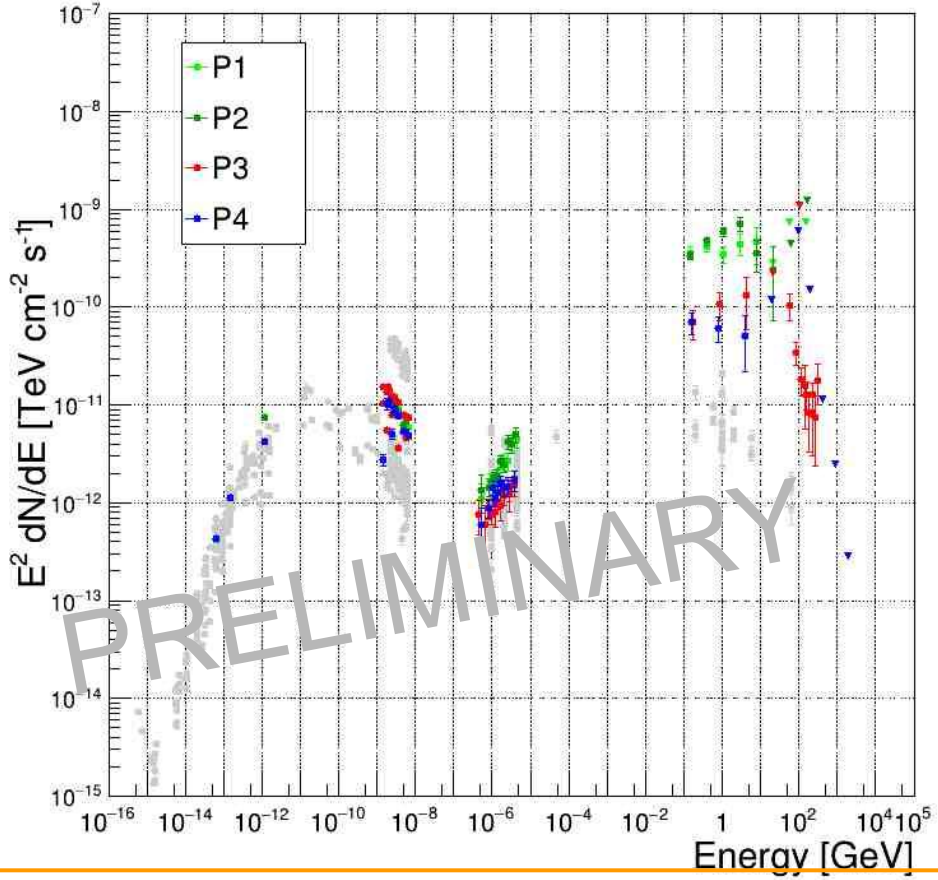
MWL SEDs from different source states

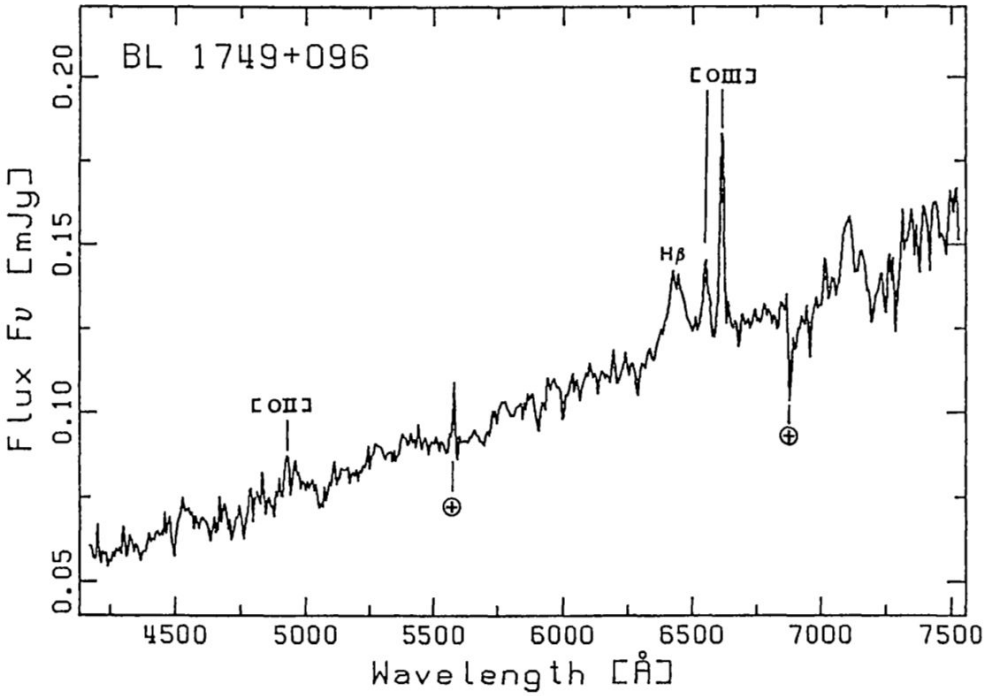
- One-zone SSC models cannot successfully describe the dataset.
- The high energy bump of the SEDs can not be explained by Compton scattering of low-energy photons by the same electrons producing the synchrotron emission at lower frequencies …



Including external fields

Luminosity of the β line to be used as value for the external photon field

- **H_β -> Line_lum= 5.x10^41 erg/s**



Optical spectrum from Stickel et al., 1988

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Modelings performed

H.E.S.S.

- Leptonic model including EC (Fabrizio Tavecchio – Maraschi &Tavecchio 2003)
- Lepto-hadronic model (Fabrizio Tavecchio+ Matteo Cerruti)
- Proton-synchrotron model (Matteo Cerruti – Cerruti et al. 2015)

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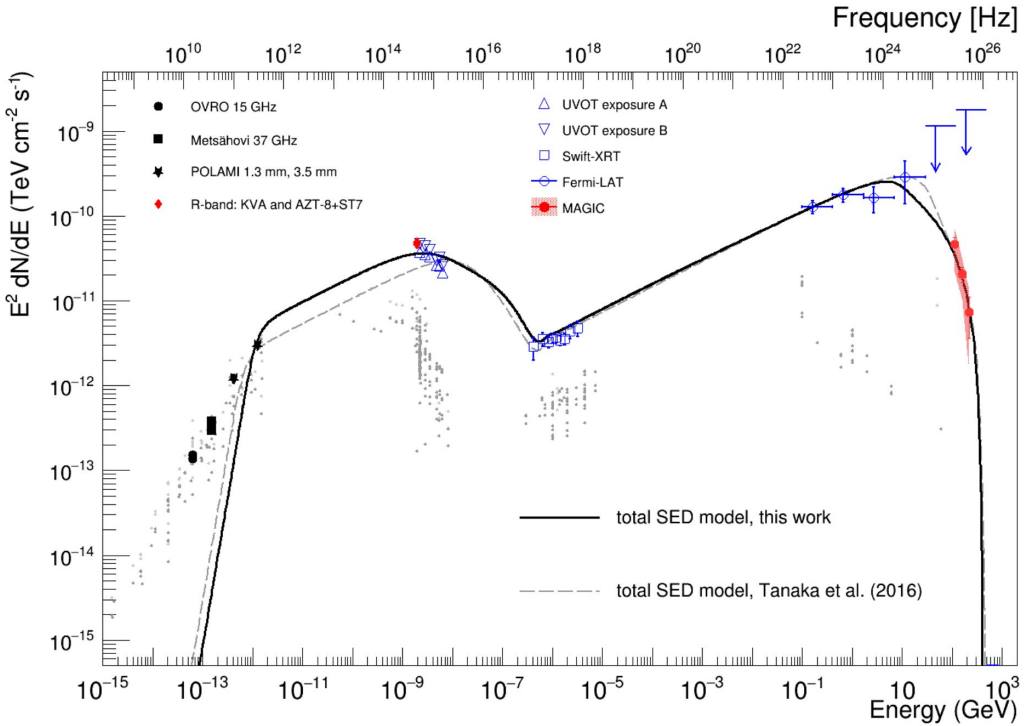
Similar case to S4 0954+65

For S4 0954+65,

IR torus emission was assumed as external photon field



MAGIC collaboration, (2018) A&A 617, A30

Giant Paolo Padovani disappointed

What this transition means?

FSRQs:

Radiatively efficient

High-excitation galaxies

BL Lacs:

Radiatively inefficient

Low-excitation galaxies

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Conclusions

- The Inverse Compton part of the SED has been investigated for the first time using VHE gamma-ray data.
- The discovery of VHE γ-ray emission happened during a very bright flare triggered by *Fermi*-LAT and observed by many instruments simultaneously in July 2016.
- We present the first broadband study of the source which includes VHE gamma-ray data, taken by MAGIC and H.E.S.S. arrays.
- The dataset challenges SSC models.
- The presence of emission lines in the optical spectrum and the considerations drawn from the modeling point to the fact that the source is not a pure BL Lac but a transitional source between BL Lac and FSRQs.

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Thanks for your attention!

Image Credit: Chiara Righi (@chirighi)

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