



Observations of the FSRQ 3C 279 during the flaring states 2017 and 2018 with H.E.S.S.

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On behalf of the H.E.S.S. collaboration



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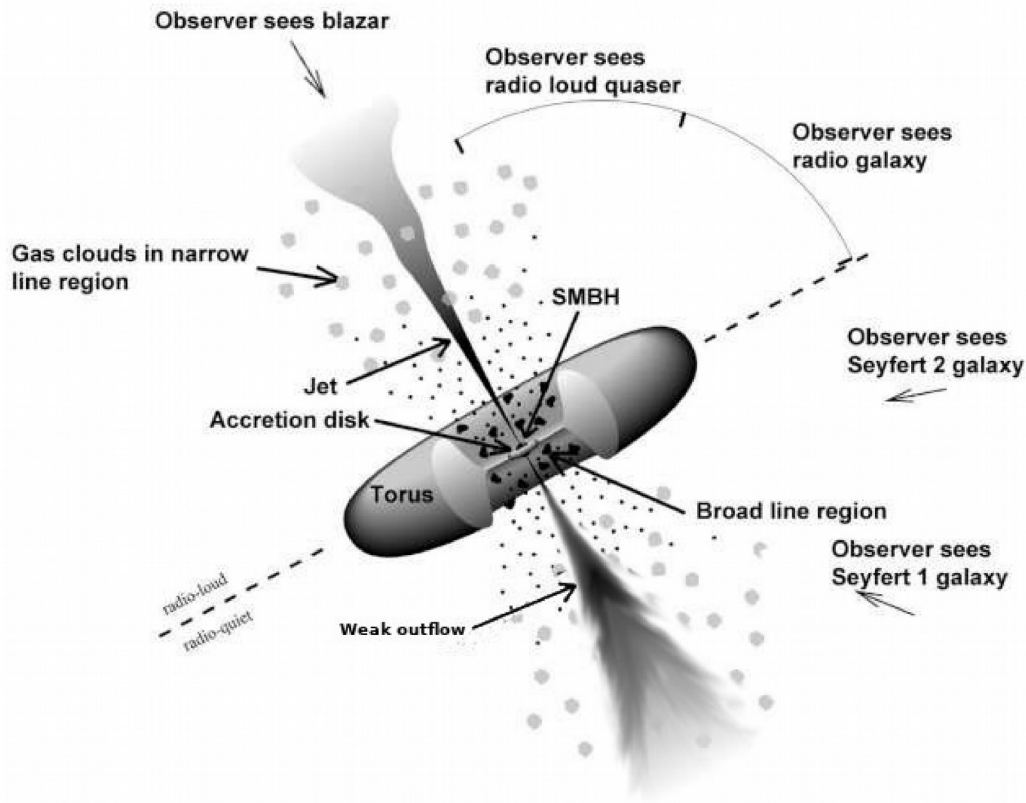
H.E.S.S.



- Only IACT in South hemisphere
 - in Namibia

- 5 Cherenkov telescopes
 - 960 pixels camera X 4
 - 2048 pixels camera X 1
- Only hybrid IACT array
 - 12m diameter mirror X 4
 - 28m diameter mirror X 1
 - Experience for CTA
- Sensitive to gamma-ray energies from ~ 30 GeV to 100 TeV
 - Energy resolution : $\sim 10\%$
 - Angular resolution : $\sim 0.1^\circ$
 - Sensible to 1% Crab at 5σ in Xh

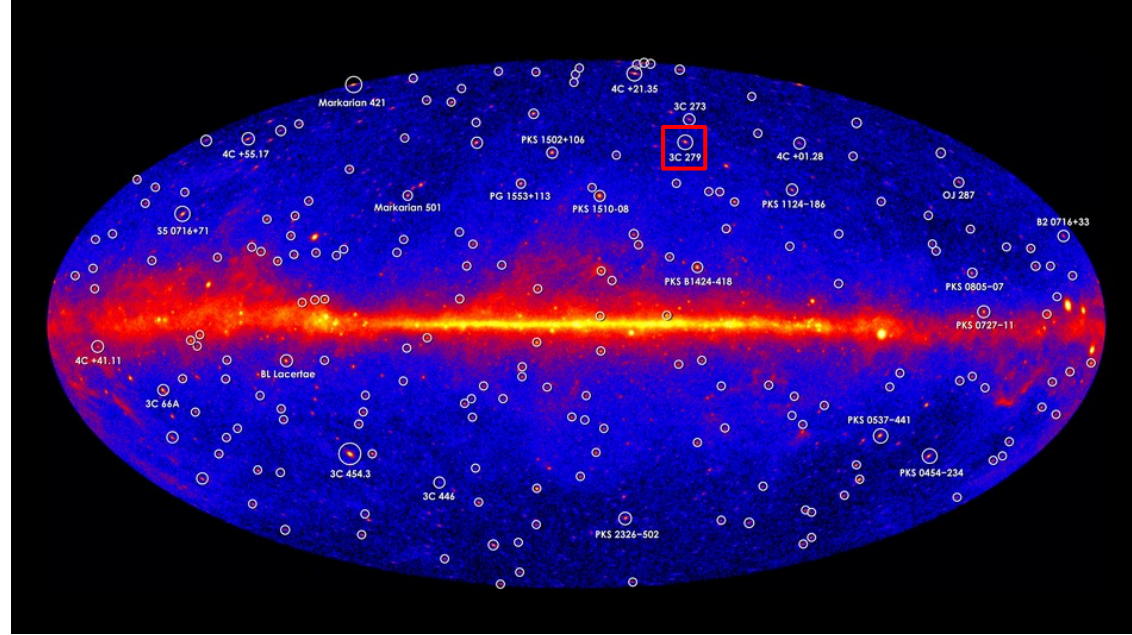
Blazars



- Active galactic Nuclei
 - SMBH
 - accretion disk
 - dust torus, BLR, gas clouds,...
- Blazars
 - relativistic jet
 - Visible non thermal emission
- FSRQ
 - emission-line dominated optical spectra
 - VHE photons by external inverse compton

3C 279

- FSRQ at redshift $z = 0.536$
- One of the brightest FSRQs seen by the Fermi-LAT
- Intense variability since years
 - Multiple flares in 2014/2015
 - Again in 2017/2018
- 6 H.E.S.S. observations campaigns in 2017/ 2018
 - 2 optical triggers
 - 4 HE triggers

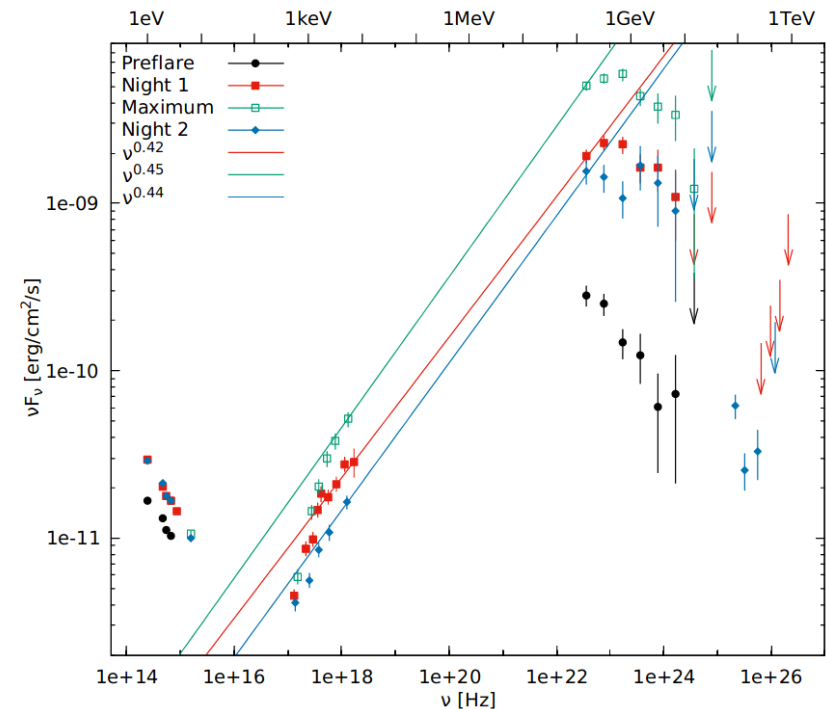


5 year Fermi-LAT sky map.
Credit: NASA/DOE/Fermi LAT Collaboration

- Detected by H.E.S.S. in 2015 during the brightest flare seen by Fermi-LAT on this source
 - detection at 8.7σ significance by H.E.S.S. in one night
- published : arXiv:1906.04996

Main results of the 2014/2015 campaign

- Using the *Fermi*-LAT + H.E.S.S. detection of “night 2”
- Minimum distance of the emission region from the blackhole
 - lack of absorption feature by the BLR photons
 - $r > 2.2 R_{\text{ly}\alpha} = 1.7 \times 10^{17} \text{ cm}$
- One-zone models cannot reproduce the observed characteristics of the 2015 flare



2015 SED taken from the 2014/2015 paper
published in A&A : 2019A&A...627A.159H

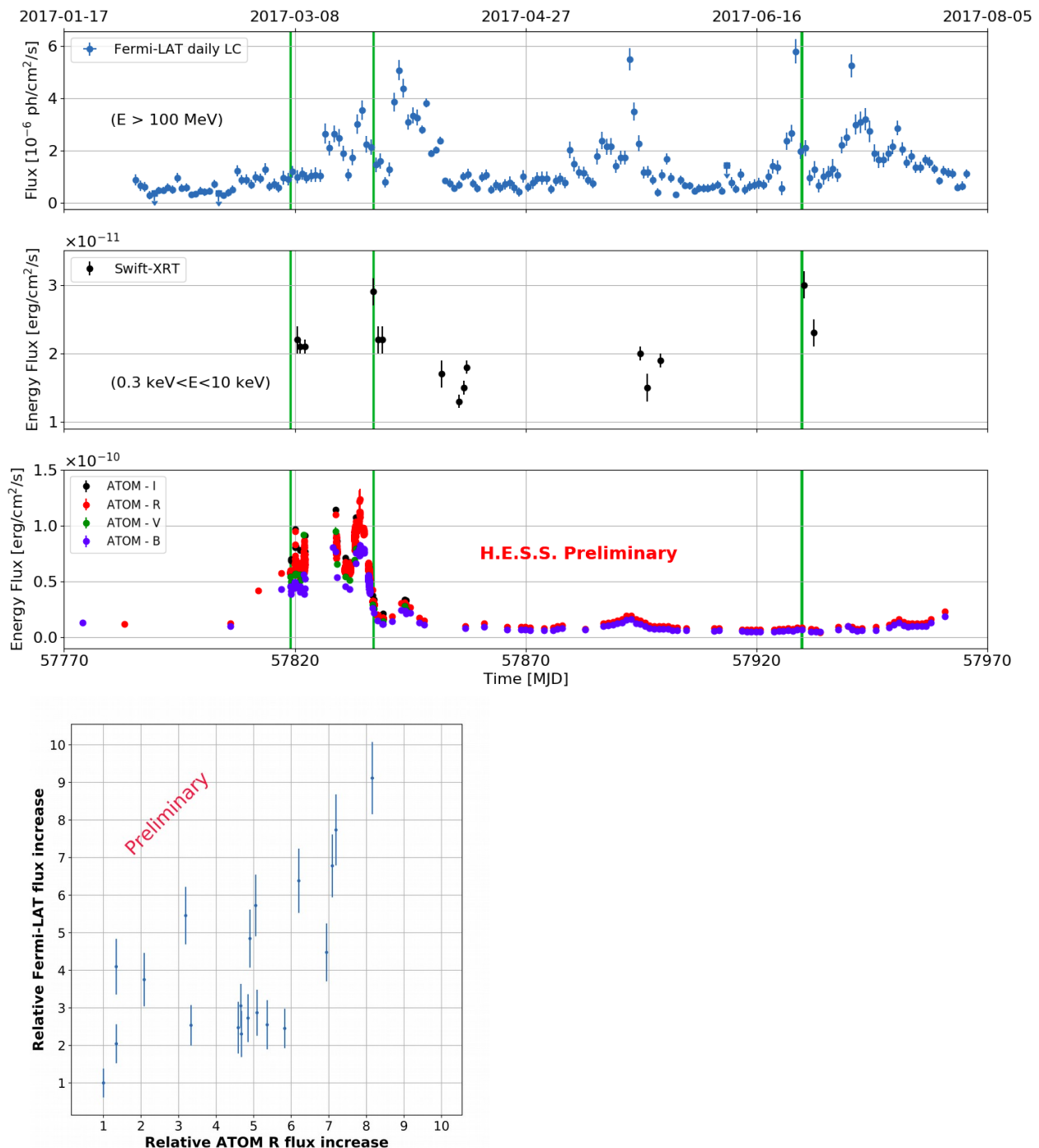
Detailed modelling in paper



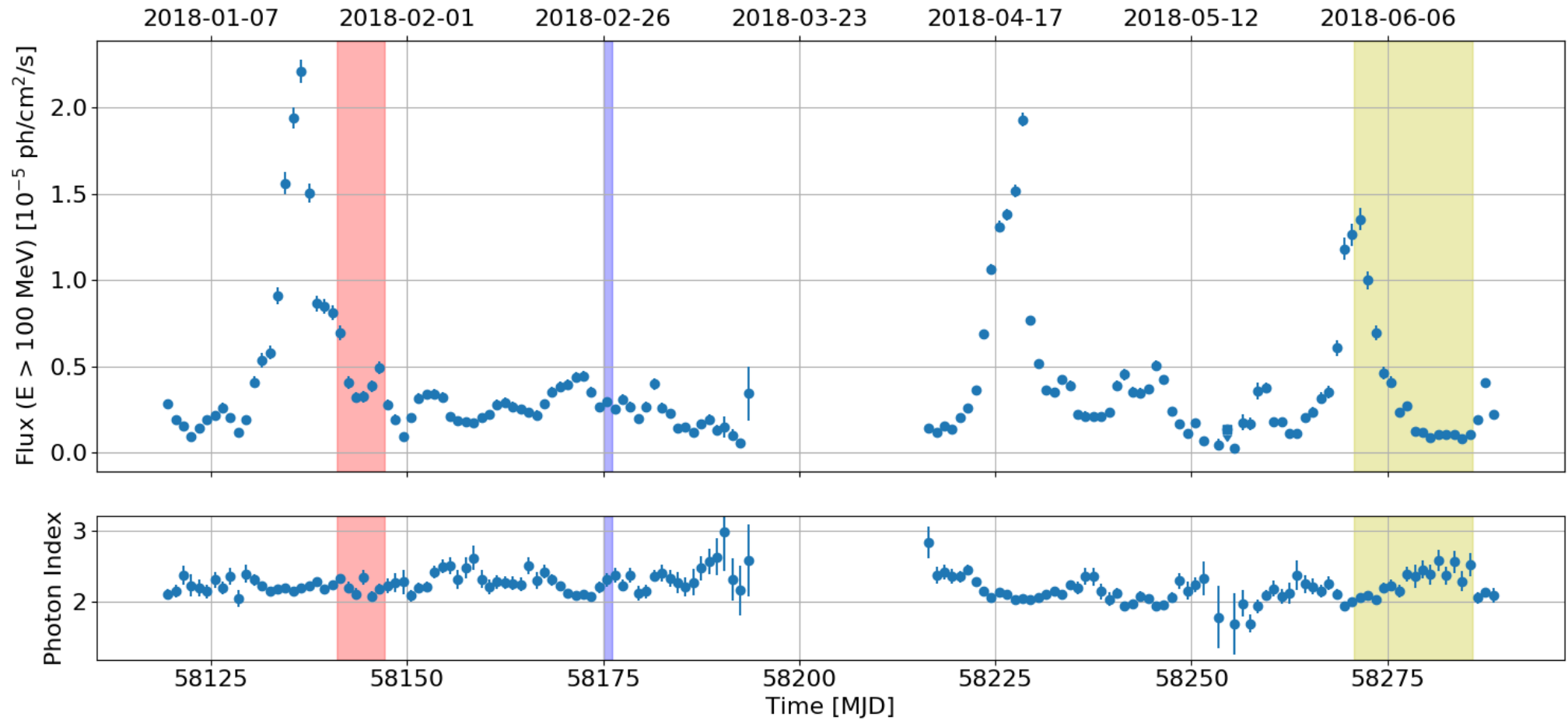
2017 Activity

- Intense optical activity in march
- HE activity later with no optical counterpart
- No H.E.S.S. detection
- Mild correlation between optical and HE during the optical flare
 - Pearson correlation coefficient :

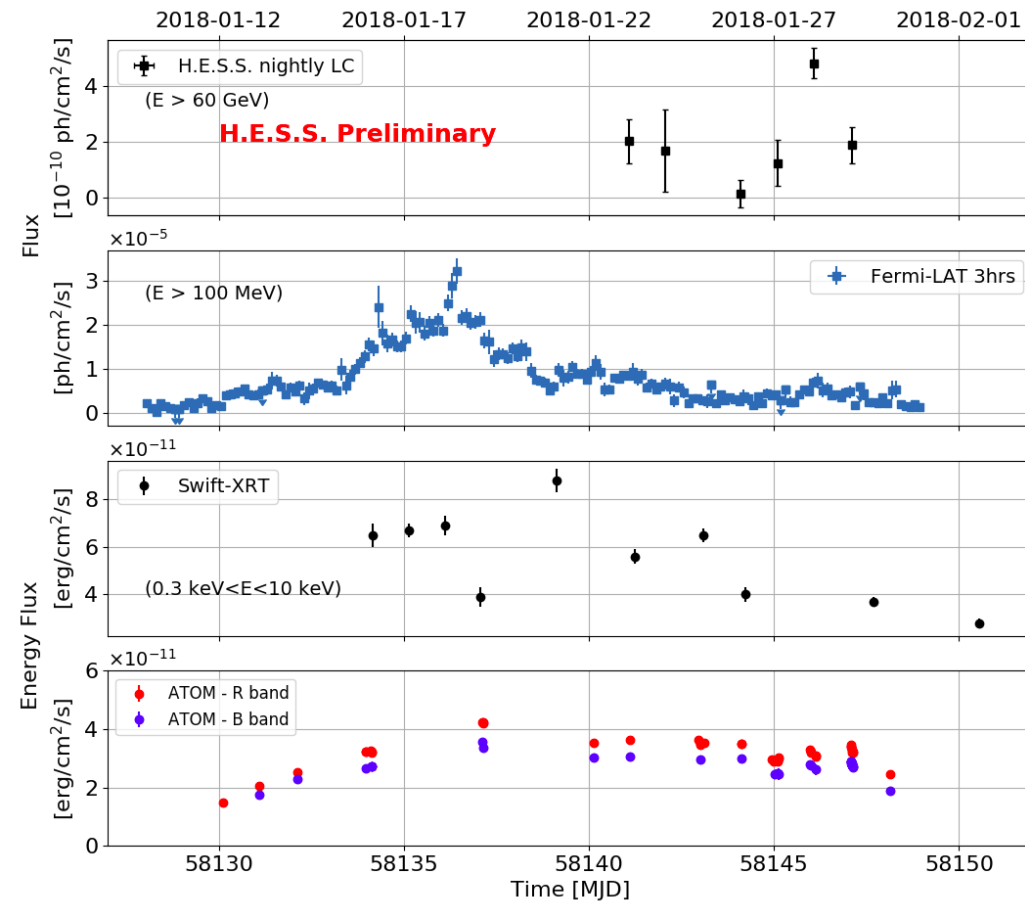
$$\rho_{Opt/HE} = 0.61 \pm 0.05$$



2018 Overview

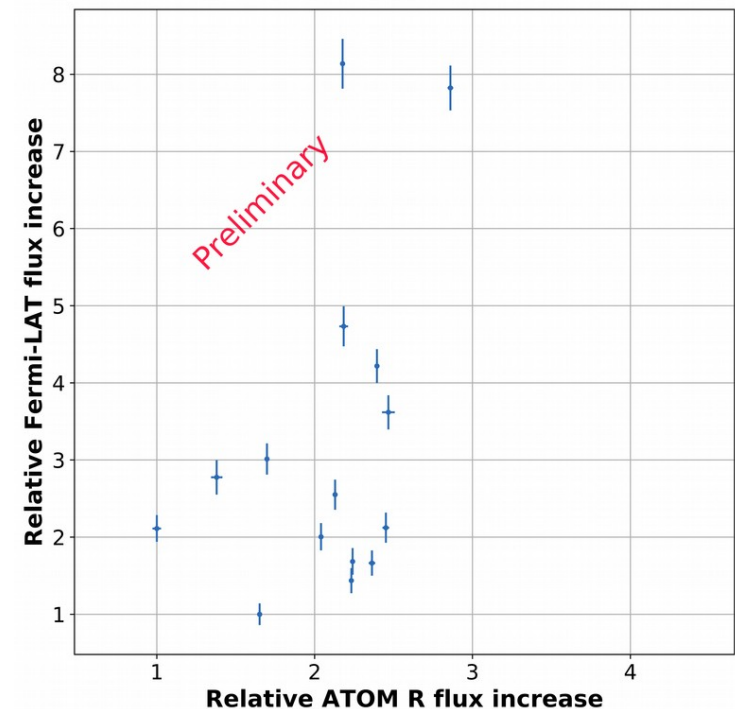


January 2018 : a VHE flare



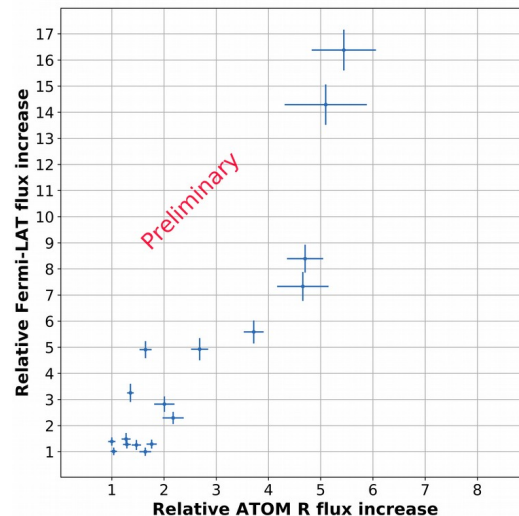
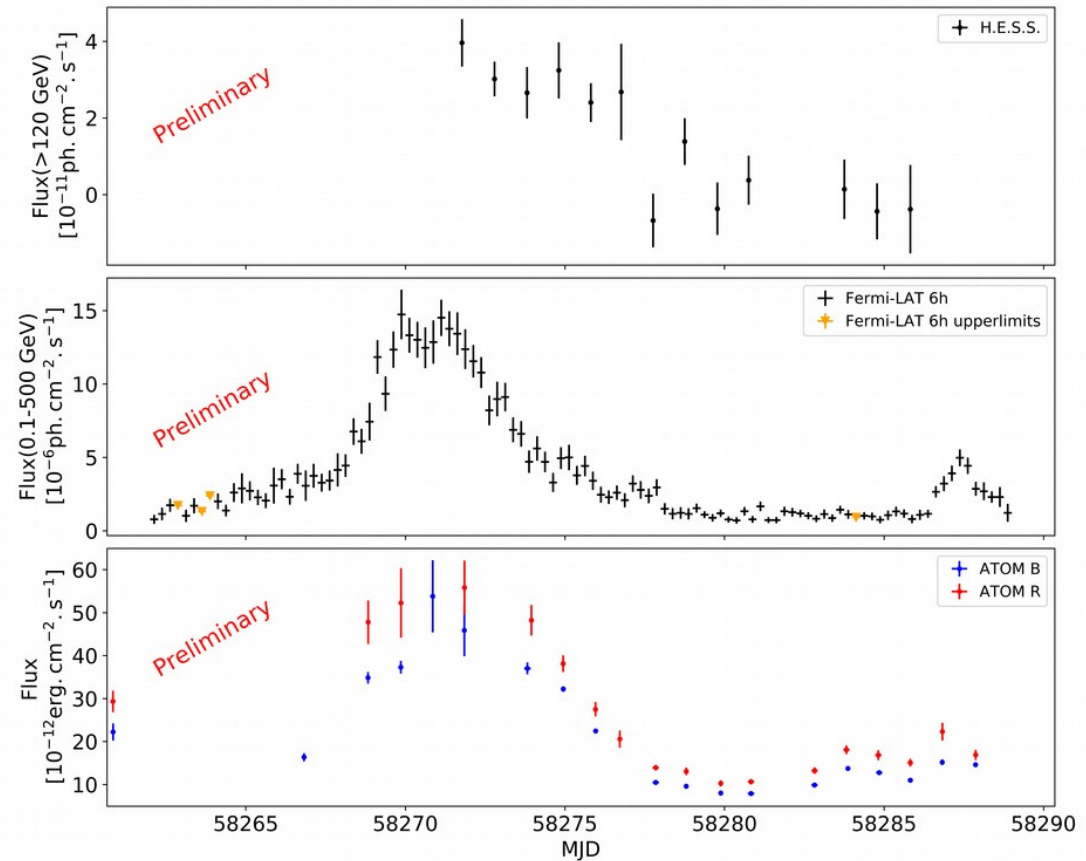
- HE and optical correlation is weak (Pearson correlation: $\rho_{Opt/HE} = 0.41 \pm 0.02$)
- Evolution in different time scales

- Late VHE follow-up due to weather
 - Still caught the end of the HE flare and optical still high
 - Detection of a short VHE flare with small HE flux increase $\rightarrow 10.7 \sigma$



June 2018 : long coverage

- Start observations at the HE maximum
- Monitored the full decreasing trend and the following days
- High state found to be up to MJD 58277
 - 13.5 σ in Mono
- Consistent evolution of Fermi-LAT and H.E.S.S. fluxes



- Strong HE/optical correlation
 $\rho_{\text{Opt/HE}} = 0.91 \pm 0.03$
- HE variations $> 2 \times$ optical variations



Conclusion

- Detection of an intense and short VHE flare in January 2018
- June 2018 flare, a multiwavelength flare
 - Correlation between optical and HE very strong
 - Multiple days detection by H.E.S.S. with hint of HE and VHE good correlation

More to come later!