Extragalactic Observations with HESS: Past and Future

A. M. Taylor for the HESS Collaboration

International Collaboration of ~300 scientists from 13 countries
(Germany - France - Austria - Poland - Ireland - United Kingdom -
Netherlands - Australia - Armenia - Sweden - Namibia - South Africa - Japan)
Gamma-Ray Frontier

The “Low-Threshold Era”: HESS-II New 28m telescope: 2012

Other Gamma-Ray Developments: HAWC monitoring
FACT monitoring

....and Fermi, AGILE....
The HESSI and HESSII Eras

H.E.S.S. Phase I: 2002-2012
- 4 telescopes of 12m
- 100 GeV - 100 TeV

H.E.S.S. Phase II: 2012++
- Addition of CT5 to the array: 28m
- ~30 GeV - 100 TeV

CT5 allows $E < 100$ GeV measurements
— best for:
- High redshift AGN + GRBs
- EBL studies at large $z$
Lessons Learnt from HESSI-Intrinsic Spectra + EBL

1. **BL Lacs** (Blazars)
2. **FSRQs** (Blazars)
3. **FR1s** (Radio Galaxies)
4. **Starburst** Galaxies

However, a large portion of our results have come from the class 1. What lessons have been learnt about BL Lac blazars?

Higher order moments of the intrinsic spectra are only probeable for the brightest AGN during their outburst episodes.
The HESS II AGN Era Begins

PKS 2155-304
z=0.12

PG 1553+113
z~0.5

2017A&A 600A 89H, 1612.01843
The Rise of the FSRQ AGN

- Achieved a threshold energy of 66 GeV
- Detection of VHE emission places limits of \(~0.1\) pc on minimum distance of emission site
- Evidence of intrinsic curvature in spectra implies emission sites could be further out still
- Short variability detected in the Fermi domain (minute timescale) suggests emission site is compact

3C279 - June 2015 flare

Night 2: 16-17 / 06 / 2015

\[ E^2 \frac{dN}{dE} \text{[erg cm}^{-2} \text{s}^{-1}] \]

\[ z=0.54 \]

H.E.S.S. Preliminary

Fermi-LAT

H.E.S.S.

H.E.S.S. EBL-deabs.

(see also- PKS 1510-089 and PKS 0736+017 HESS contributions)
Effective VHE Sky Follow-Ups
An AGN Transients Machine

PoS ICRC2015 (2016) 761, 1509.04458

Phenomenal level of statistics achieved in short timescale

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H.E.S.S. PRELIMINARY
HESS II as a New Transients Machine!

Note fast response time being achieved

(see HESS GRB talk + multi-messenger poster)
Conclusions

• During the HESSI era, only for the brightest AGN could the higher moments in the spectra be obtained.
• An understanding of the intrinsic spectra + EBL can only be achieved through high photon statistic observations.
• The HESSII era has now begun, leading to a rise in the FSRQ blazar class.
• Temporal variability coupled with the VHE emission are challenging to reconcile for these FSRQs.
• Big efforts are now underway to exploit the HESSII transient machine through an array of different transient follow-up alerts.