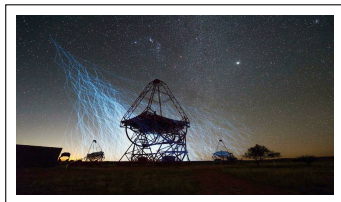
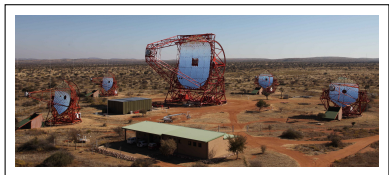


# The Extragalactic Sky with the High Energy Stereoscopic System

David SANCHEZ  
on behalf of the H.E.S.S. collaboration

LAPP - Laboratoire d'Annecy-le-Vieux de Physique des Particules, Université de Savoie, CNRS/IN2P3, France

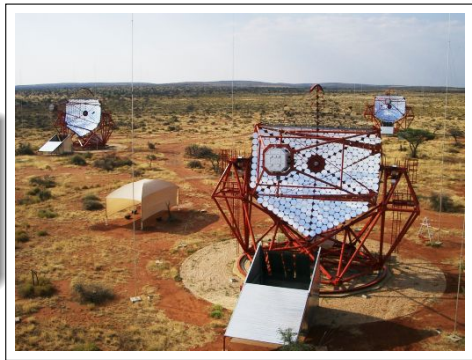
October, 23, 2014, Fermi symposium, Nagoya



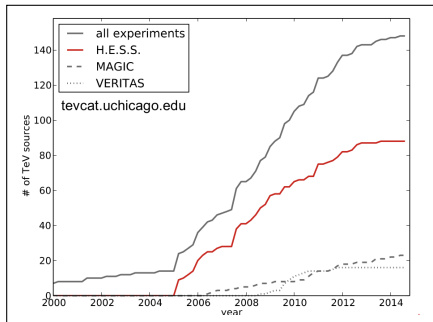
# The H.E.S.S. experiment

- Four 12m telescopes
- FoV of 5 degrees
- Energy threshold 100 GeV
- Angular resolution  $< 0.1$  deg

In operation since 2004



# H.E.S.S. legacy



- more that 80 objects discovered,
- GRBs : more than 20 follow-up, no detection (yet)
- Monitoring of objects, ToO



# The H.E.S.S. experiment: Phase II

- CT5: 28m telescope (FoV 3.5 deg)
- Energy threshold  $\approx 50\text{GeV}$
- Angular resolution from 0.4 deg to less than 0.1 deg

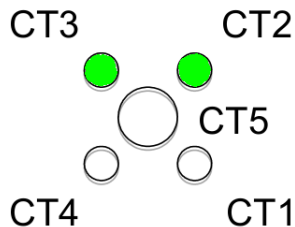
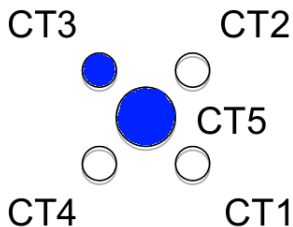
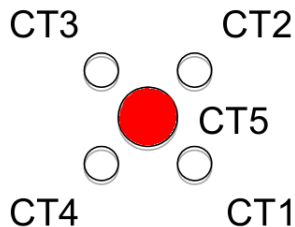


**Sept. 28, 2012:** inauguration of the H.E.S.S. II telescope  
Commissioning phase completed. Currently in normal operation phase



# The H.E.S.S. experiment: Phase II

- Mono configuration
- Hybrid configuration
- Stereo with 12m telescopes





## Recent results from the H.E.S.S. experiment

- Monitoring of Sources
- Flare of PG 1553+113

## First results of H.E.S.S. phase II

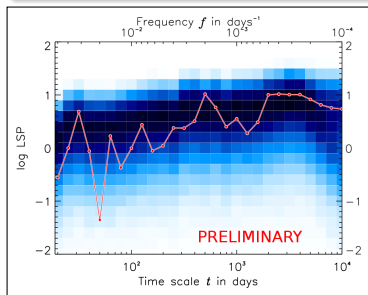
- Mono results
- Prospects

# Monitoring of PKS 2155-304 (H.E.S.S. phase I)

Consistent with flicker noise

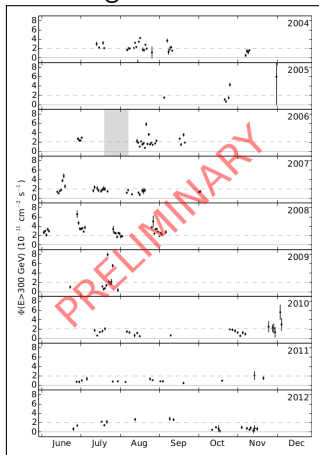
$$\rightarrow \beta = 0.9 \pm 0.2$$

flaring state  $\beta = 2$  on time-scales  $< 10d$



- Flare,  $\beta$  changes from 1 to 2.
- The power spectrum is stationary, break from 1 to 2 exists

## Night-wise LC



# The flare of PG 1553+113 with H.E.S.S.

poster 8.21 Probe of Lorentz Invariance Violation effects and determination of the distance of PG 1553+113.

- PG1553+113 : HBL
- discovered by H.E.S.S. (2006-03)
- Unknown  $z$

Danforth et al. 2010 constrains the redshift to  $z > 0.40$ , specifically putting it in the range: **0.43 - 0.58**

- Atel 3977 - March 19th, 2012 : MAGIC and Swift detection of renewed activity from the blazar PG1553+113 during a MWL campaign
- Atel 4069 - April 26th, 2012 : MAGIC detects an unprecedented high VHE gamma-ray emission from the blazar PG 1553+113

## MAGIC detects an unprecedented high VHE gamma-ray emission from the blazar PG 1553+113

ATel #4069; [Juan Cortina \(IFAE Barcelona\) for the MAGIC collaboration](#)  
on 26 Apr 2012; 14:22 UT  
Credential Certification: [Juan Cortina \(cortina@ifae.es\)](mailto:Juan.Cortina@ifae.es)

Subjects: Infra-Red, Optical, X-ray, Gamma Ray, TeV, VHE, Request for Observations, AGN, Blazar

Referred to by ATel #: [4078](#), [4107](#)

The source PG 1553+113 is a well-known TeV emitter, likely located at redshift 0.4-0.5 (Danforth et al. 2010). Its state has been monitored by MAGIC since February 2005. In March 2012, a high emission state at VHE, X-ray, optical, and infrared wavelengths was reported (ATel #3977).

## MAGIC and Swift detection of renewed activity from the blazar PG1553+113 during a MWL campaign

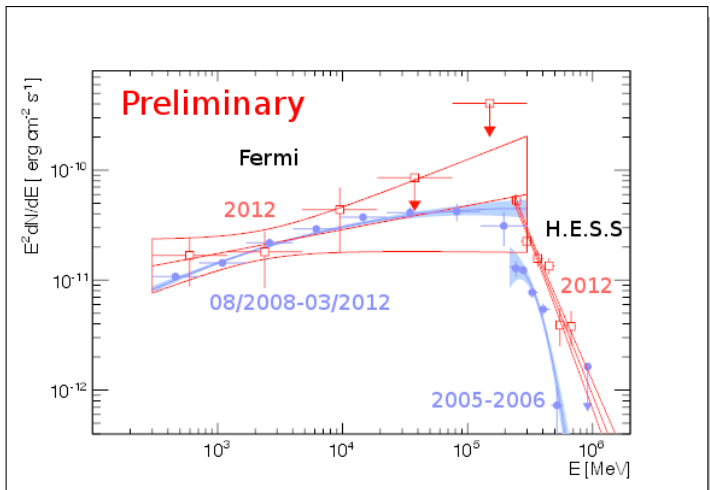
ATel #3977; [Juan Cortina \(IFAE Barcelona\) on behalf of the MAGIC Collaboration](#)  
on 19 Mar 2012; 18:00 UT  
Credential Certification: [Juan Cortina \(cortina@ifae.es\)](mailto:Juan.Cortina@ifae.es)

Subjects: Radio, Infra-Red, Optical, Ultra-Violet, X-ray, Gamma Ray, >GeV, TeV, VHE, Request for Observations, AGN, Blazar

Referred to by ATel #: [4069](#)

The MAGIC telescopes have observed an increased VHE ( $E > 100$  GeV) gamma-ray flux from the blazar PG 1553+113 in the course of a multi-wavelength campaign started on 2012 February 23.

# Fermi and H.E.S.S. SED



Quiet and Flare periods poster 8.21



# Redshift determination: New Bayesian approach

**Bayes Theorem:** the posterior probability is

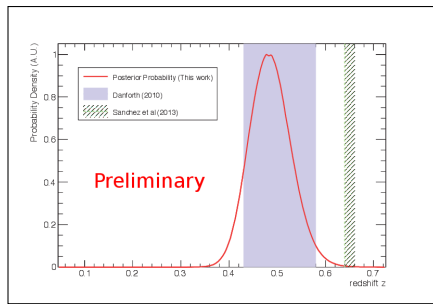
poster 8.21

$$P(\theta|Y) \propto P(\theta)P(Y|\theta)$$

- $P(Y|\theta)$  is the likelihood and is estimated **using the H.E.S.S. data.**
- $P(\theta) = P(z|N\Gamma)P(N)P(\Gamma)$

- $P(N) = \text{cst}$
- $P(\Gamma) \propto N(\Gamma, \Gamma_{\text{Fermi}}, \sigma_{\Gamma})$  if  $\Gamma < \Gamma_{\text{Fermi}}$  or  $P(\Gamma) = \text{cst}$
- $P(z) \propto \exp(-\tau(z))$

**Fermi and H.E.S.S. systematic uncertainties included in  $\sigma_{\Gamma}$**



$$z = 0.49 \pm 0.04$$

$$0.41 < z < 0.56$$



# View of AGNs with CT5

## CT5 mono results of Blazars

- Calibration targets
- Monitoring and MWL purposes

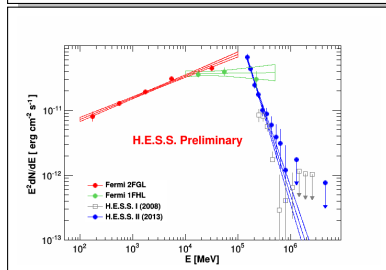
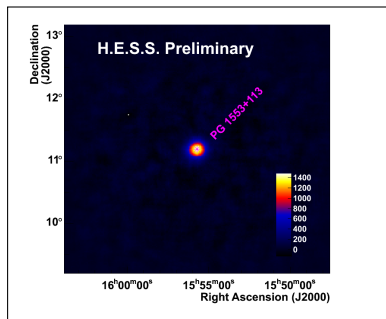


# PG 1553+113

Soft source, well suited for CT5 mono

Live Time	15.1 h
Excess	2508 $\gamma$
Significance	26.6 $\sigma$
Zenith	$\approx 35^\circ$
Rate	$2.77 \pm 0.11 \gamma/\text{min}$

Comparison with 2FGL and 1FHL  
Systematics at low energy are still under study



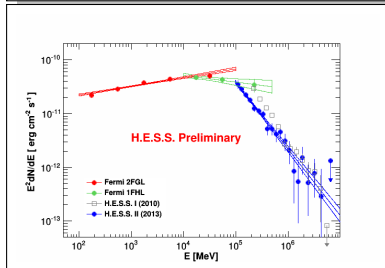
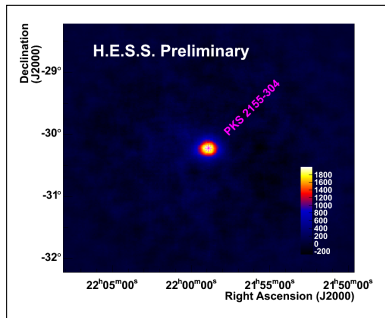


# PKS 2155-304

Bright and well studied Blazar

Live Time	42.9 h
Excess	4442 $\gamma$
Significance	29.7 $\sigma$
Zenith	$\approx 21^\circ$
Rate	$1.72 \pm 0.06 \gamma/\text{min}$

Comparison with 2FGL and 1FHL  
Systematics at low energy are still under study



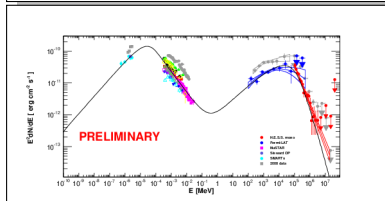
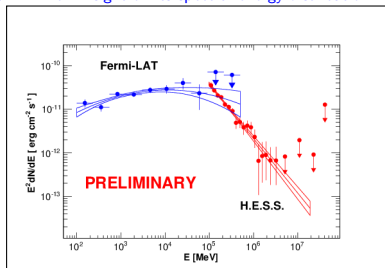
# NuSTAR, *Fermi* and H.E.S.S. campaign on PKS 2155-304

poster 8.22 [Multiwavelength campaign on the HBL PKS 2155-304 : A new insight on its spectral energy distribution](#)

- April to October 2013
- 7 simultaneous NuSTAR and H.E.S.S. observations
- *Fermi*-LAT monitoring: Pass 8 irfs

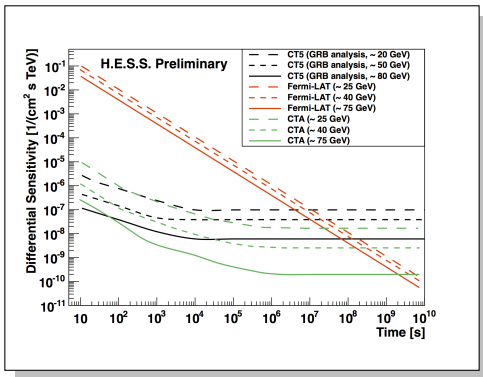
## Results

- *Fermi*-H.E.S.S. agreement, IC peak well measured
- IC contamination in X-ray under study
- SSC calculation



H.E.S.S.

# Detection of transients and GRBs



H.E.S.S. CT5 is well suited for transients and GRBs

- Fast repointing of CT5 after GCN alert
- Development on Transients detection methods



More fun ahead!  
Stay tuned!