Deep H.E.S.S. Observations of the Supernova Remnant RX J0852.0 – 4622

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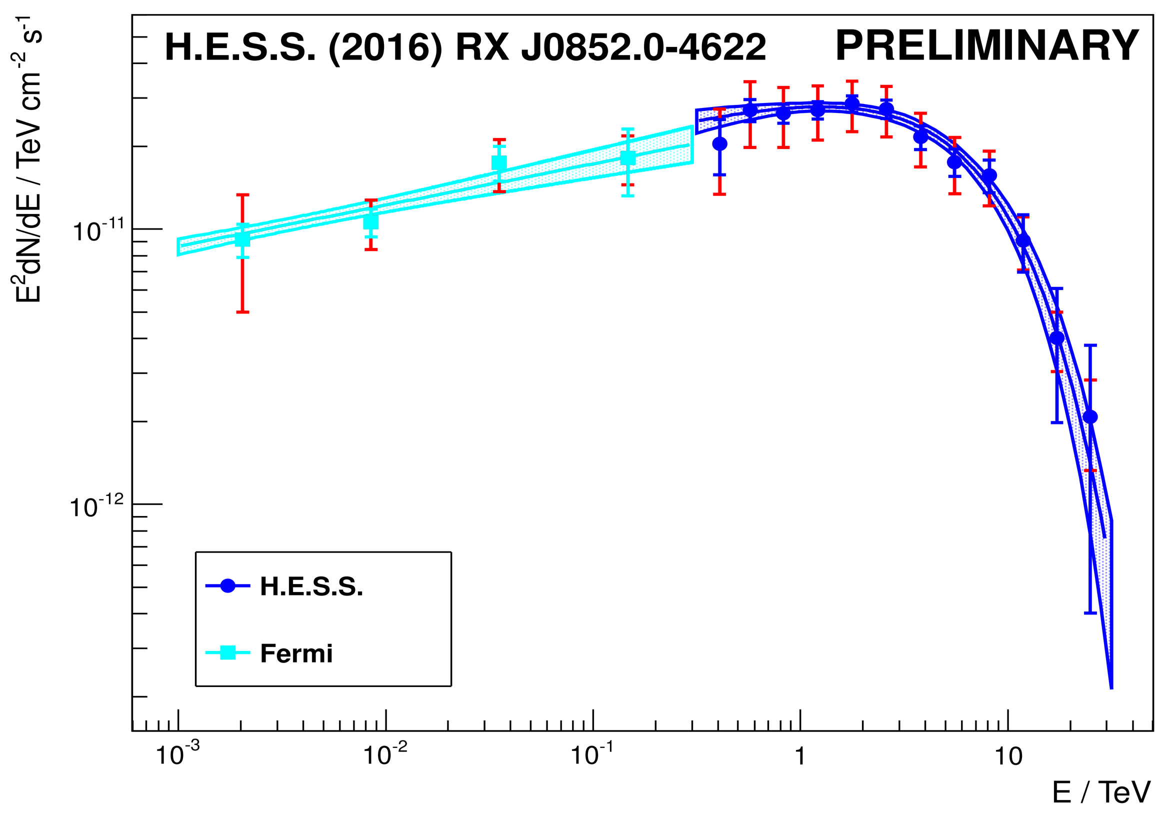
H.E.S.S. Observations

- The data used in analysis was collected between 2004 and 2009
- Roughly doubled data set
- The exposure times (normalized to an offset of 0.7) available for morphological and spectral analyses amount to 60 h and 39 h respectively.
- Improved statistics and analysis methods allow more detailed studies of the morphology, of the spectrum and finally a spatially resolved spectroscopy of the source can be performed.

Spectrum

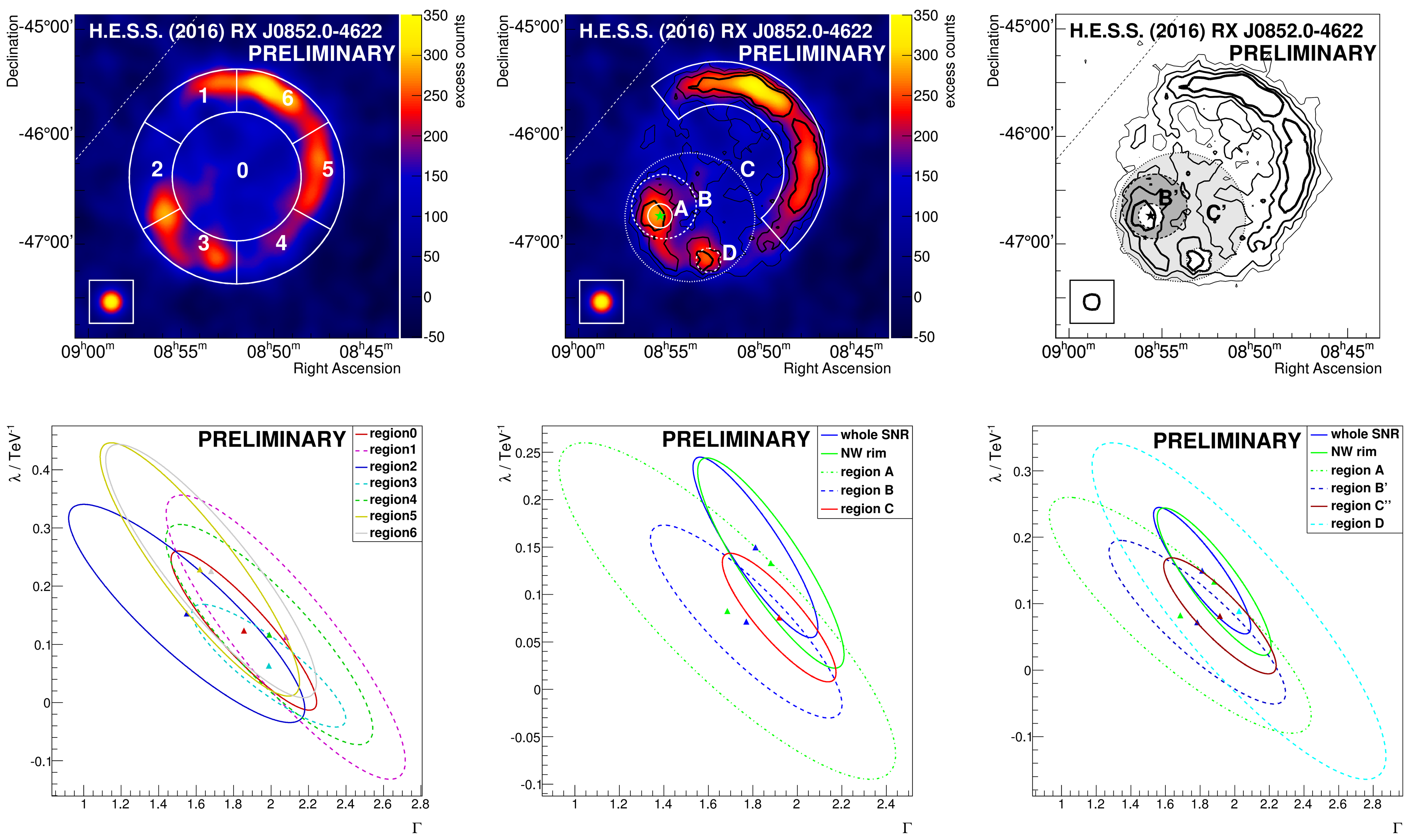
- A clear curvature in the spectrum has been measured, revealing an exponential cut-off
- Smooth connection of the TeV spectrum with the Fermi measurement at GeV energies
- The revised flux makes RX J0852.0 – 4622 the brightest steady source in the sky above 1 TeV.

Figure description: H.E.S.S. and *Fermi* spectra for the entire SNR with statistical and systematic errors. The *Fermi* measurement was taken from [4]. The figure shows the spectral points with 1σ statistical (light and dark blue lines for *Fermi* and H.E.S.S. respectively) and systematical (red lines in both cases) uncertainties together with the spectral fits and their 1σ statistical uncertainty (shaded bands).



model	formula	Φ_0 / cm^{-2}s^{-1}TeV^{-1}	Γ	β	E_{cut} / TeV	significance wrt the PL model
PL	$\mathrm{d}\Phi/\mathrm{d}E = \Phi_0(E/E_0)^{-\Gamma}$	$(27.4 \pm 0.9)\,10^{-12}$	2.30 ± 0.03	n.a.	n.a.	n.a.
CPL	$\mathrm{d}\Phi/\mathrm{d}E = \Phi_0(E/E_0)^{-\alpha-\beta\log(E/E_0)}$	$(28.8 \pm 1.1)\,10^{-12}$	1.89 ± 0.07	0.23 ± 0.04	n.a.	7.3σ
ECPL	$\mathrm{d}\Phi/\mathrm{d}E = \Phi_0(E/E_0)^{-\Gamma}\exp(-E/E_{cut})$	$(32.2 \pm 1.5)\,10^{-12}$	1.81 ± 0.08	n.a.	6.7 ± 1.2	7.7σ

Spatially resolved spectroscopy



Regions description

- 0 (the central part of the SNR) and 1 – 6 (the shell) - regions defined to test for spectral variation across the SNR.
- A,B, and C - regions to study the flux contribution from the pulsar wind nebula (PWN) around PSR J0855 – 4644 coincident with the shell of the SNR [1, 3]. Region A reflects a point-source assumption and regions B and C encompass 7 σ and 5 σ contours, respectively.
- D - region to test whether the southern enhancement is a separate source or not
- $B' = B \setminus A$ and $C' = C \setminus B \setminus D$ - regions to search for the softening of the spectrum of the possible TeV PWN.

Spectral variation

- No significant spectral variation found across the SNR

Pulsar wind nebula

- Region B is the only region with spectral parameters deviating more than 3σ (pre-trials) from the spectrum of the rest of the SNR
- Points to the contribution of the PWN to the overall flux and to the possible size of the TeV PWN
- Possible flux contribution of the PWN is estimated at 4 – 8% of the whole SNR flux

Bibliography

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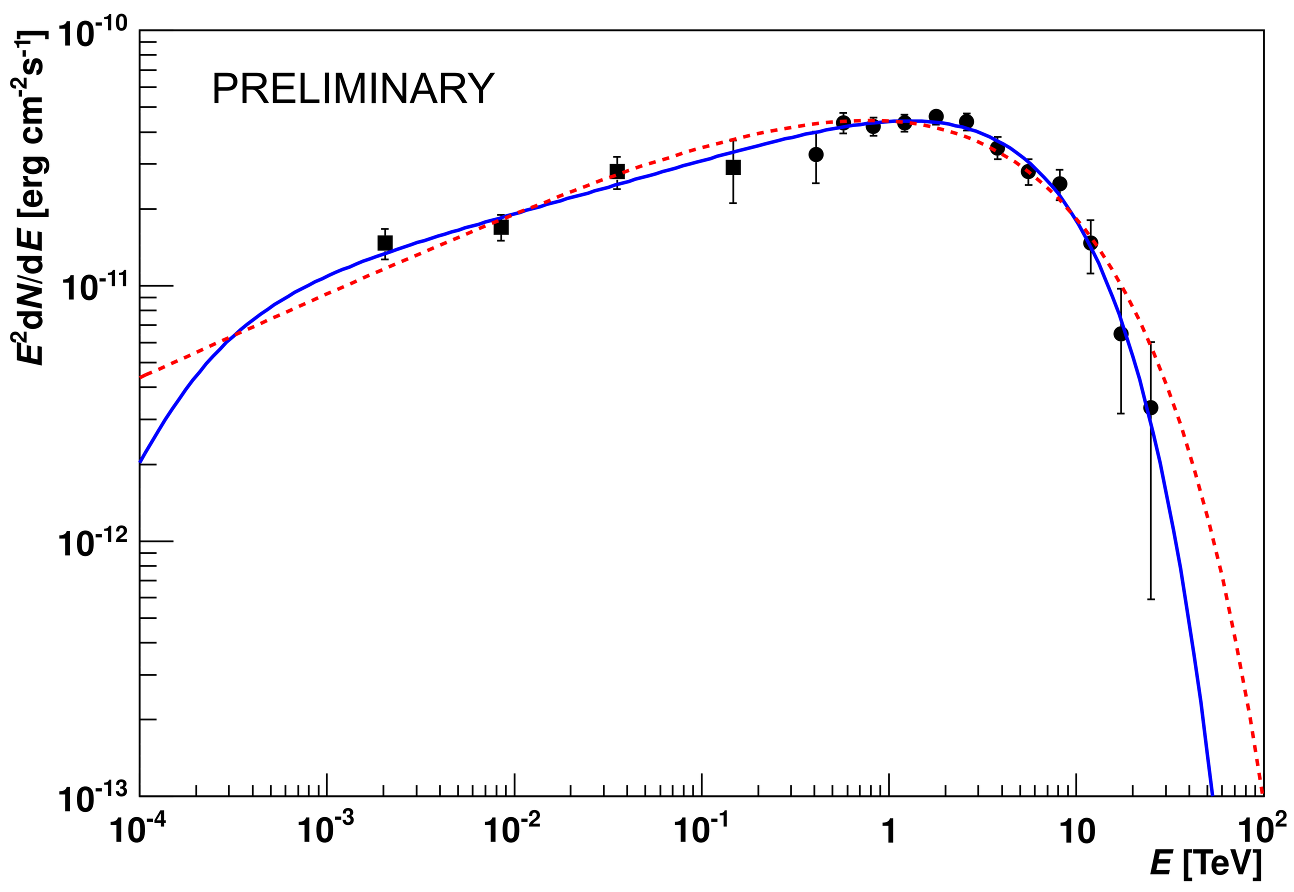
[3] Paz Arribas, M., Schwanke, U., Sushch, I., Komin, N., Acero, F., and Ohm, S. for the H. E. S. S. Collaboration 2011, Proceedings of the 32nd ICRC, vol. 7, p. 140-143 [astro-ph/1203.2532]

[4] Tanaka, T., Allafort, A., Ballet, J., et al. 2011, ApJL, 740, L51

Present-time parent particle population

- Extraction of the present-time parent particle population spectrum based on the combined GeV-TeV data
- Particle spectrum assumed to follow: $N(E) = \frac{N_0}{4\pi d^2}\left(\frac{E}{1\,\mathrm{TeV}}\right)^{-p}\exp\left(-\frac{E}{E_{cut}}\right)$
- Distance to the SNR of 750 pc adopted [2]
- Leptonic: only CMB photons are connsidered
- Fit probabilities: 0.39 for leptonic scenario (red dashed line) and 0.95 for hadronic scenario (blue solid line)

scenario	parameter	value	Δ_{stat}	Δ_{syst}
hadronic	$\frac{N_0}{4\pi d^2}\left[\frac{n}{1\,\mathrm{cm}^{-3}}\right]$ / 10^8 $\mathrm{TeV}^{-1}\mathrm{m}^{-2}$	7.8	0.3	2.0
	p	1.83	0.02	0.11
	E_{cut} / TeV	55	6	13
	$W\left[\frac{n}{1\,\mathrm{cm}^{-3}}\right]$ / 10^{49} erg	7.11	0.32	1.86
leptonic	$\frac{N_0}{4\pi d^2}$ / 10^6 $\mathrm{TeV}^{-1}\mathrm{m}^{-2}$	7.8	0.6	3.1
	p	2.33	0.03	0.33
	E_{cut} / TeV	27	1	12
	W / 10^{47} erg	4.06	0.31	1.72



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