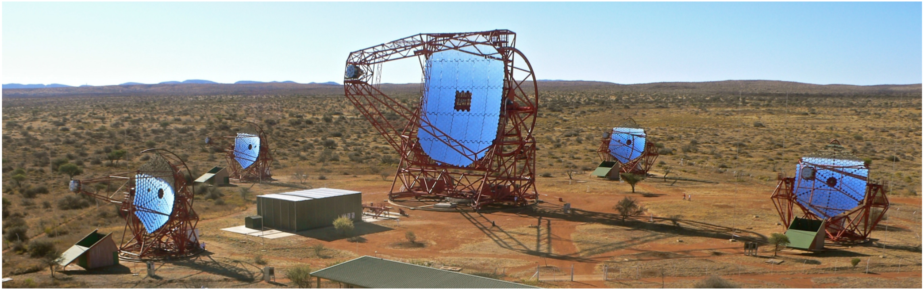
Revisiting the PeVatron candidate MGRO J1908+06 with an updated H.E.S.S. analysis.

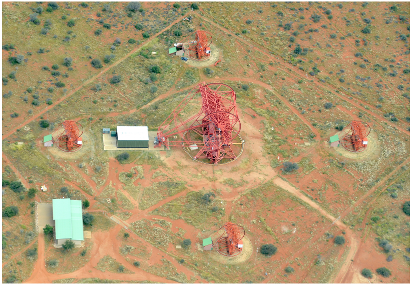


D. Kostunin, L. Mohrmann, E. de Ona Wilhelmi, V. Joshi, A. Mitchell, S. Ohm, B. Khélifi, L. Giunti, A. Sinha for the H.E.S.S. Collaboration

High Energy Stereoscopic System

Namibia, 23°16'17"S 16°30'00"E, 1800 m a.s.l.

- Energy range 30 GeV – 100 TeV
- Enery resolution ~15%
- Angular resolution ~5'
- Source position $\sim 10"$
- Observations ~1000 h/year



H.E.S.S. phase I (Sep. 2002)

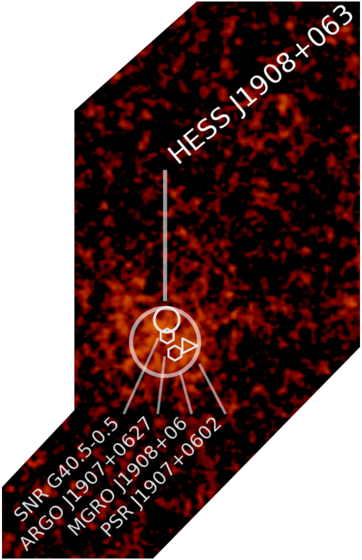
- 4 telescopes: ⌀12 m, 107 m^2
- Stereoscopic reconstruction
- 960 PMTs/camera, FoV 5°

H.E.S.S. phase II (Sep. 2012)

- 5th telescope: ⌀28 m, 600 m^2 (largest IACT in the world)
- 2048 (until Oct. 2019) / 1758 (now) PMTs, FoV 3.5°
- Energy threshold ~30 GeV
- Fast response of CT5: >90% of targets in 60 s

MGRO J1908+062/HESS J1908+063

- Detected by Milagro, confirmed by H.E.S.S. in TeV range
- Detected by HAWC and LHAASO beyond 100 TeV
- Hints for neutrino emission from IceCube $(\mathrm{TS} = 4.793)$
- Leptonic or hadronic scenario?
- Extended source
- Emission up to PeV energies
- Good case for testing new analysis techniques



Motivation for revisiting the source

- New H.E.S.S. data ($\sim$80 h, 50% more since HGPS)
- New analysis pipeline (`ImPACT` + `gammapy`)

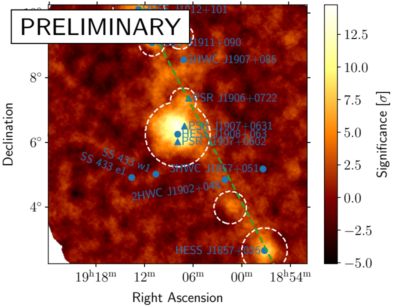
- New multiwavelength data (radio, Fermi-LAT, LHAASO)
- Populated region (2 SNRs, 3 PSRs, CO clouds) – fresh look

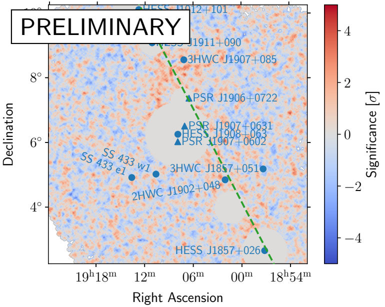
Object	d (kpc)	t_{age} (kyr)	PSR $\dot{E}$ (erg/s)	SNR size
PSR J1907+0602	3.2 ± 0.6	19.5	2.8×10^{36}	—
PSR J1906+0722	1.91	49.2	1.02×10^{36}	—
PSR J1907+0631	7.9	11.2	5×10^{35}	—
SNR G40.5−0.5	5.5–8.5	20–40	—	$22'$
SNR 3C397	8–9	1.35–5.3	—	$4.5' \times 2.5'$

**For references see corresponding proceedings*

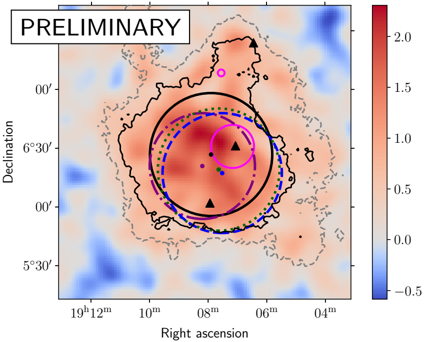
Analysis configuration

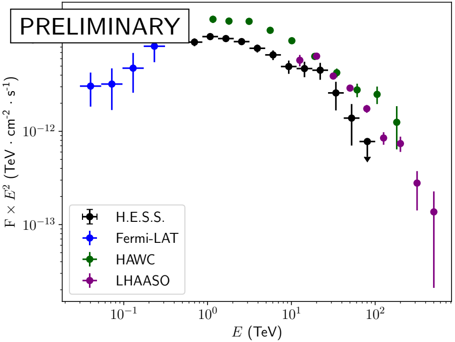
- High-quality cuts with four telescopes, maximum event offset of 2.0°
- `ImPACT` + `gammapy v0.17`, threshold of ~ 0.365 TeV
- Custom exclusion regions





Single-component comparison





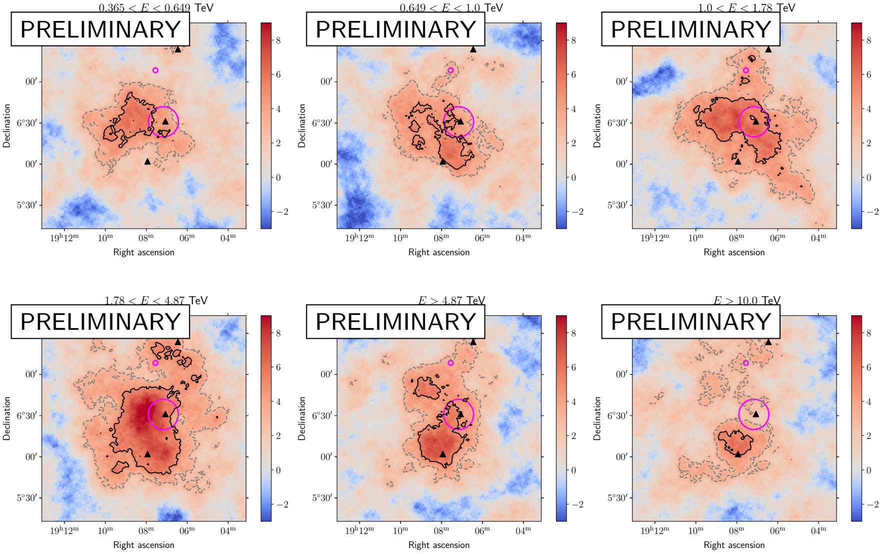
PRELIMINARY fit results:

R.A. $= 286.975° \pm 0.024°$, dec. $= 6.432° \pm 0.024°$, $\sigma = 0.524° \pm 0.018°$

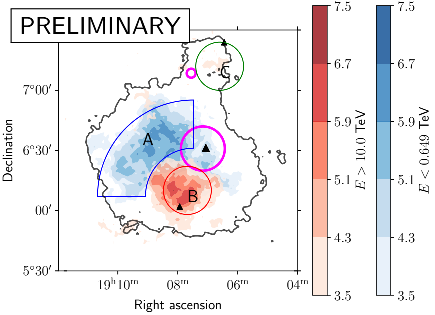
Power law parametrization: $\phi(E) = \phi_0 (E/\mathrm{TeV})^{-\Gamma}$,

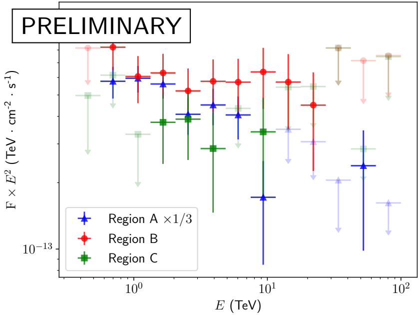
$\phi_0 = (1.02 \pm 0.05\,) \cdot 10^{-11}$ TeV^{-1} cm^{-2} s^{-1}, $\Gamma = 2.294 \pm 0.027$.

Significance maps as function of energy



Spectra from the different parts of source

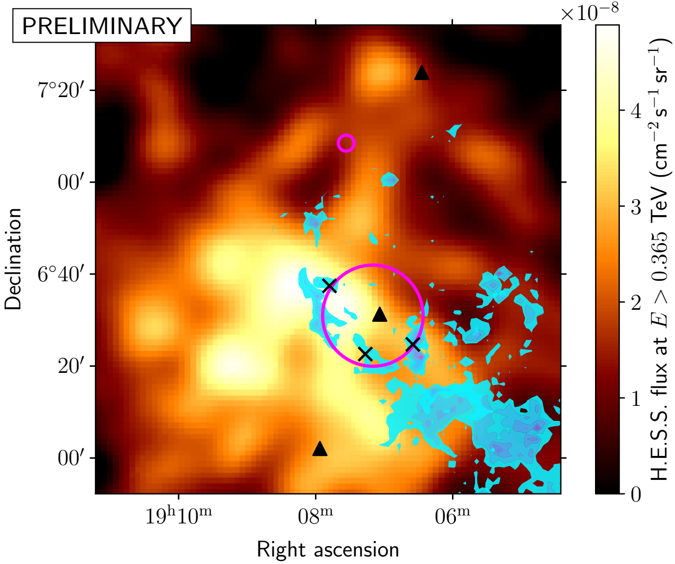




	R.A.	Dec.	Radius	Excess	ϕ_0	Γ
A	286.87°	6.12°	0.4°–0.8°	1413.9	1.89 ± 0.12	2.43 ± 0.06
B	286.92°	6.17°	0.2°	498.3	0.637 ± 0.071	2.12 ± 0.07
C	286.65°	7.20°	0.2°	197.6	0.265 ± 0.061	2.12 ± 0.13

Flux ϕ_0 units: $10^{-12}\,\mathrm{TeV}^{-1}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ // VALUES ARE PRELIMINARY

Multiwavelength picture



Conclusion

- HESS J1908+063 have been revisited using new data (+50%) and analysis pipelines (`ImPACT` + `gammapy`)
- Spectral reconstruction by new analysis technique agrees with HGPS and does not require containment correction
- We see hints on emission in the Northern part of the source
- Existing data are not sufficient to claim the origin of emission in the central part of the source, resolve more than one component or see energy-dependent morphology with high statistical significance
- Cherenkov telescopes featuring higher angular resolution are able to distinguish between different contributions — case for CTA
- Modelling of emission is in progress