THE BRIGHT AND UNKNOWN

Modelling The Hadronic Gamma Ray Morphology of HESS J1804-216

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High Energy Astrophysics Group

CTA-Oz meeting – April 2021

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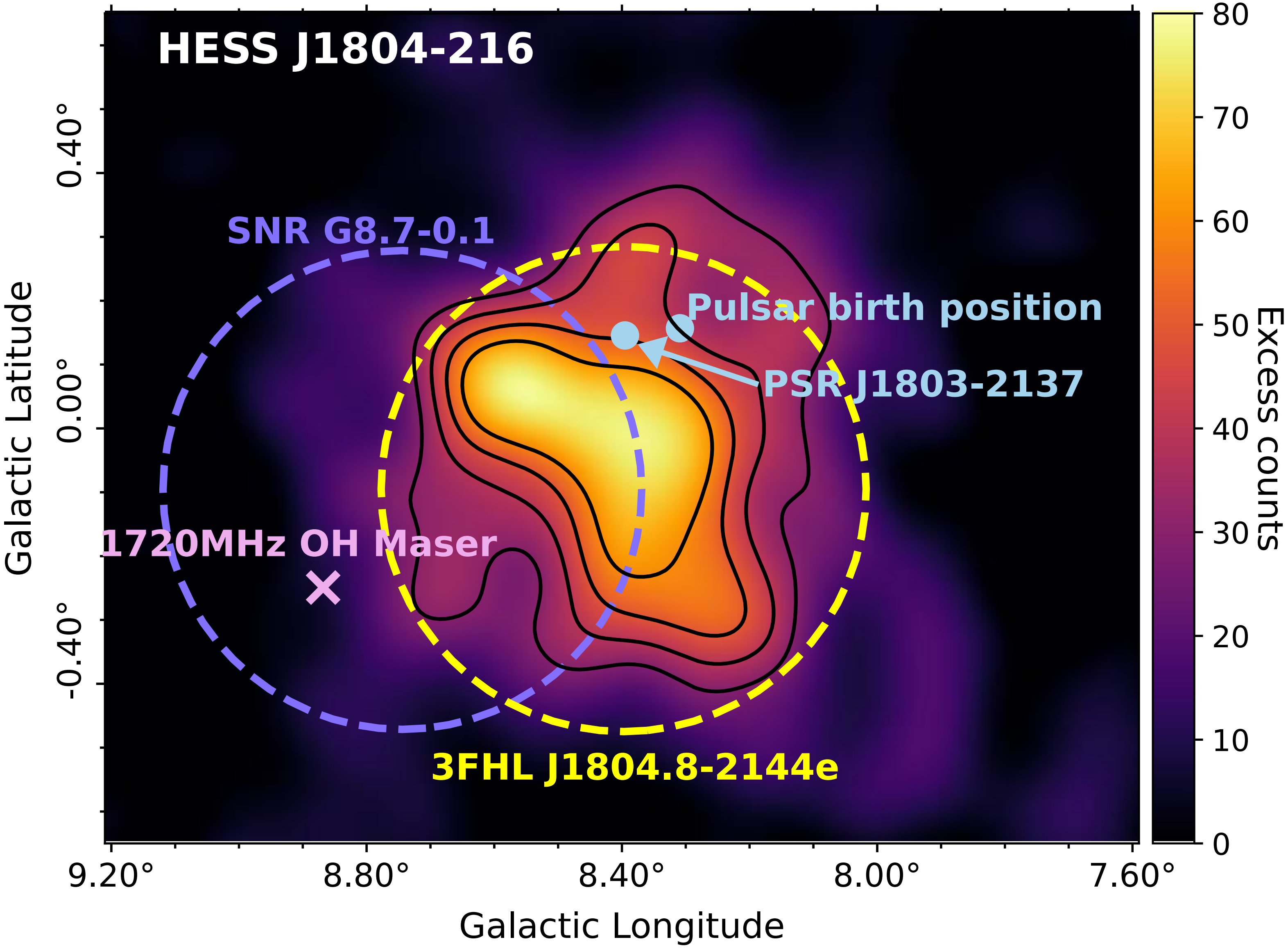
High Energy Astrophysics Group

HESS J1804-216 – The Bright and Unknown



Most plausible candidates:

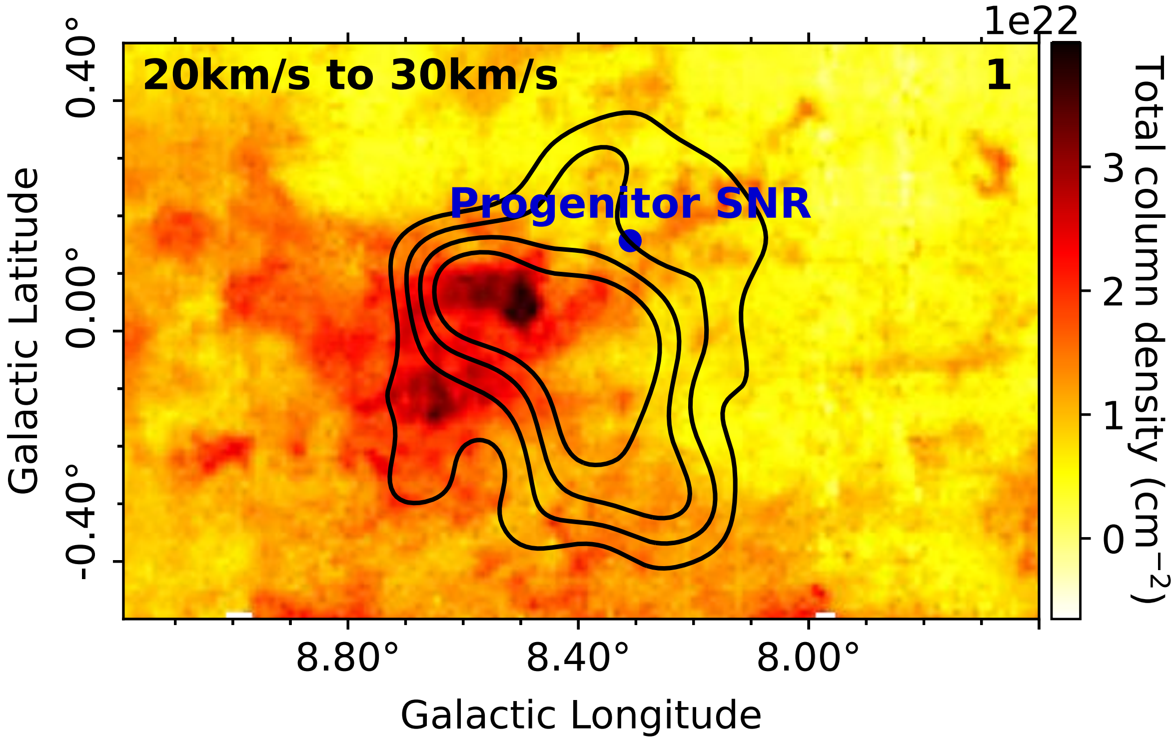
- SNR G8.7-0.1
- PSR J1803-2137

As identified in Feijen et al 2020

arXiV:2011.09021

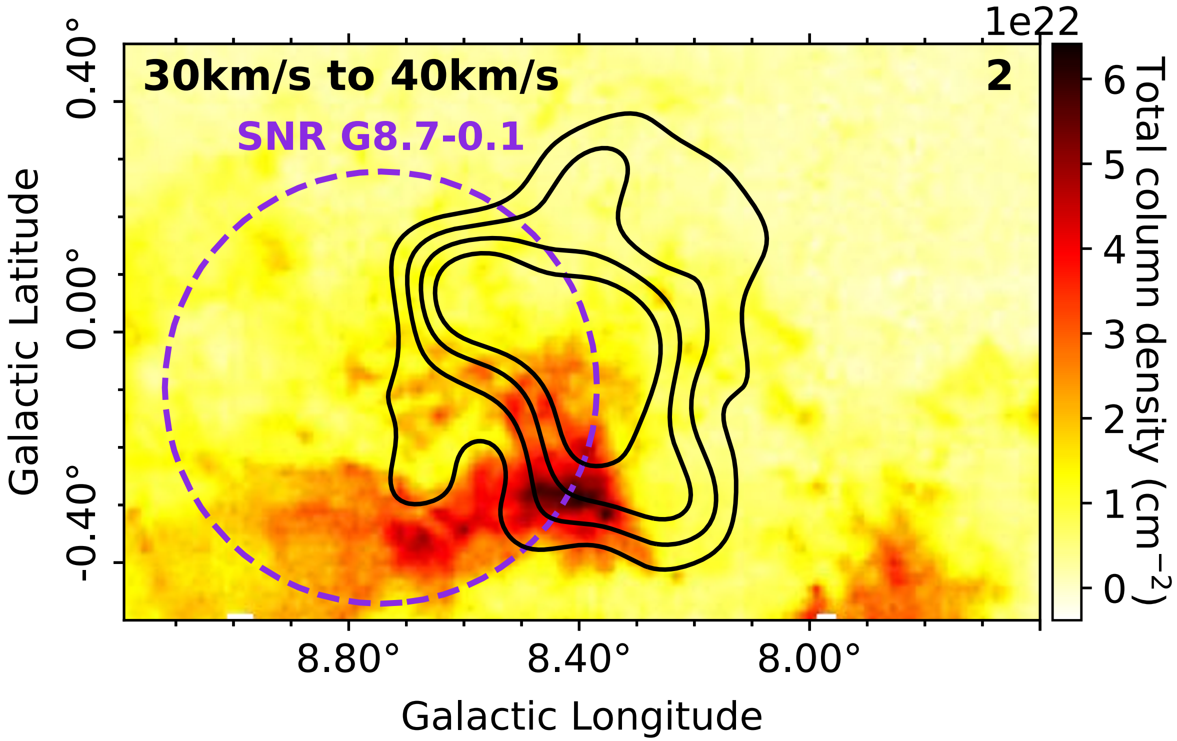
ISM towards Candidates

PSR J1803-2137



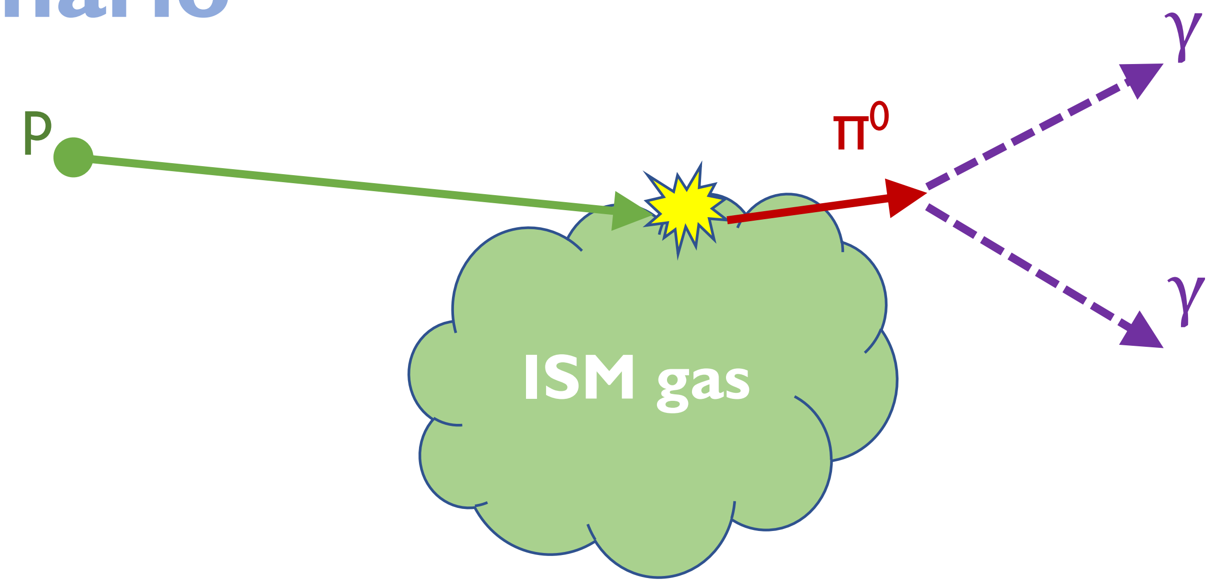
- Distance: 3.8 kpc
- Age: 16 kyr

SNR G8.7-0.1



- Distance 4.5 kpc
- Age: 15 kyr

Hadronic Scenario



Proton map

$$J(E,R,t) \propto \frac{N_0 E^{-\alpha}}{\pi^{3/2} R_{dif}^3} \exp\left(-\frac{(R-R_c)^2}{R_{dif}^2}\right)$$

(Aharonian + Atoyan 1996)

+

Gas map

(Total column density from Mopra and SGPS)

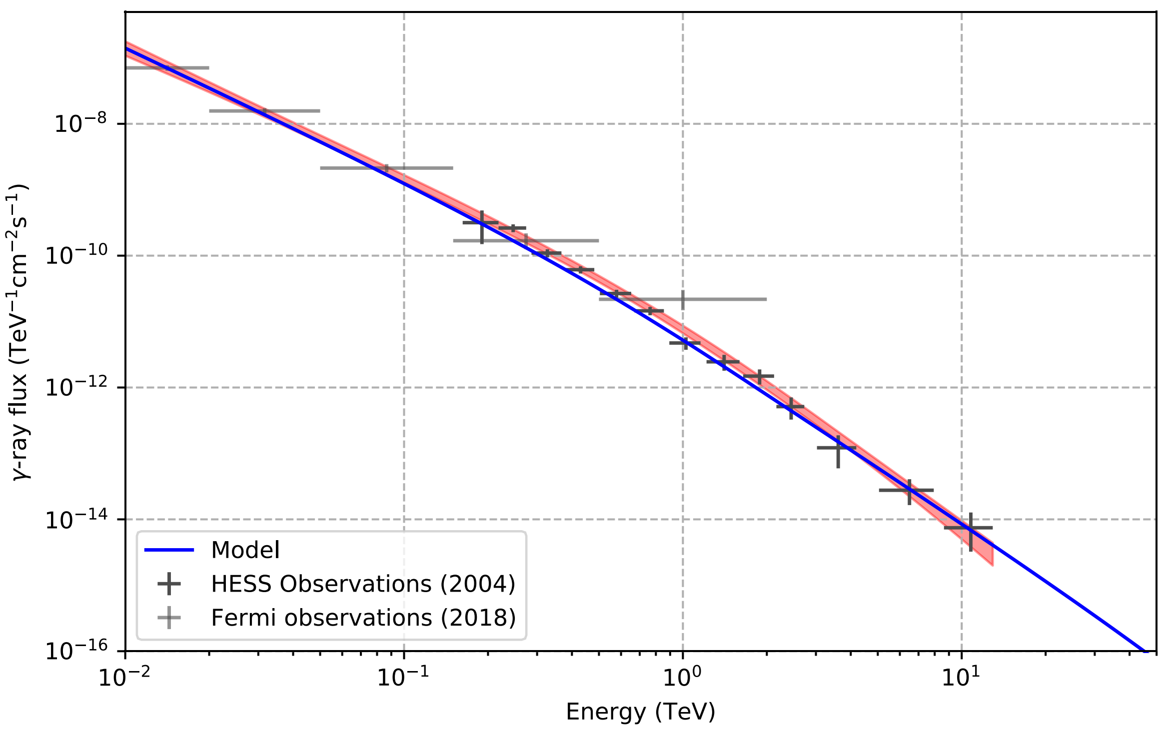
=

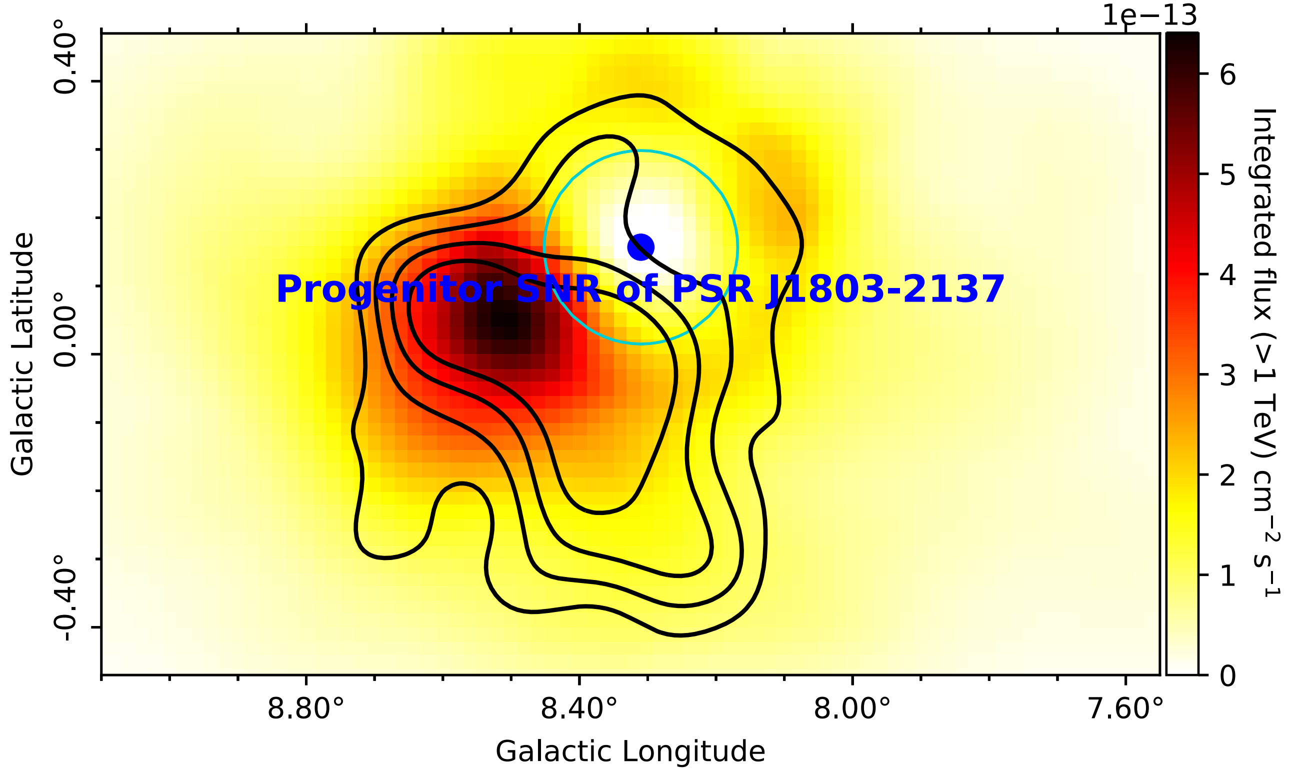
Gamma-ray map

$$F = \frac{V}{D^2}\frac{cn_H}{4\pi}\int_{E_\gamma}^{\infty} \sigma(E_p) J_p(E_p) F_\gamma\left(\frac{E_\gamma}{E_p}, E_p\right)\frac{dE_p}{E_p}$$

(Kelner et al 2006 conversion to gamma-rays)

Model examples





$\chi = 0.01$
$\delta = 0.6$
$\delta_p = 1.4$
$\alpha = 2$
$E_{budget} = 3.7 \times 10^{49}$ erg

$M_{ej} = 1M\odot$
SN type = Type 1A
$t_{sedov} = 235$ yr
$E_{max,sedov} = 1$ PeV

$R_{esc} = 0.14°$
$E_{esc} = 2.7$ TeV

CTA. Study of the H-alpha outflow.

Rami Alsulami

April 11, 2021

H Alpha outflow and Detection tool

1. Search for the possible origin of the outflow structure in Hα.
   - Hα image show a clear outflow structure in the vicinity of HESS J1825–137 and LS5039.
   - The Hα luminosity is around 10^{36} erg s^{-1}. It is higher than the YSO.
   - The ROSAT X–ray luminosity 10^{31} erg s^{-1}. There is structure at 2-3σ in X–ray. " eROSITA observation "
   - This structure extend for 175 pc at 2 kpc and we estimate an upper limit of the age to be 17 Myr.
   - The "only" potential source is LS5039 as a progenitor for this outflow.
   - This work is in its final draft and will be published soon.
2. Creating a detection tools using Hough transform in python to detect bubbles and arcs like in gas surveys (In Progress).

Outflow

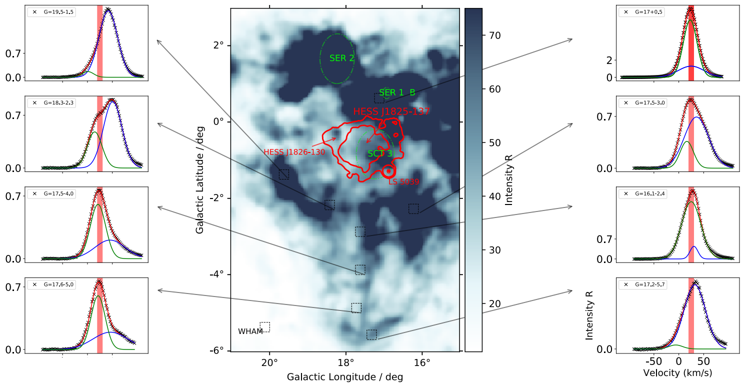


Figure: Hα image from Finkbeiner (2003) towards HESSJ1825–137 and LS5039 with gamma–ray emission (red contours of 5σ, 10σ and 50σ) (H.E.S.S. Collaboration et al. 2018) with velocity spectra extracted from WHAM H data from several regions.

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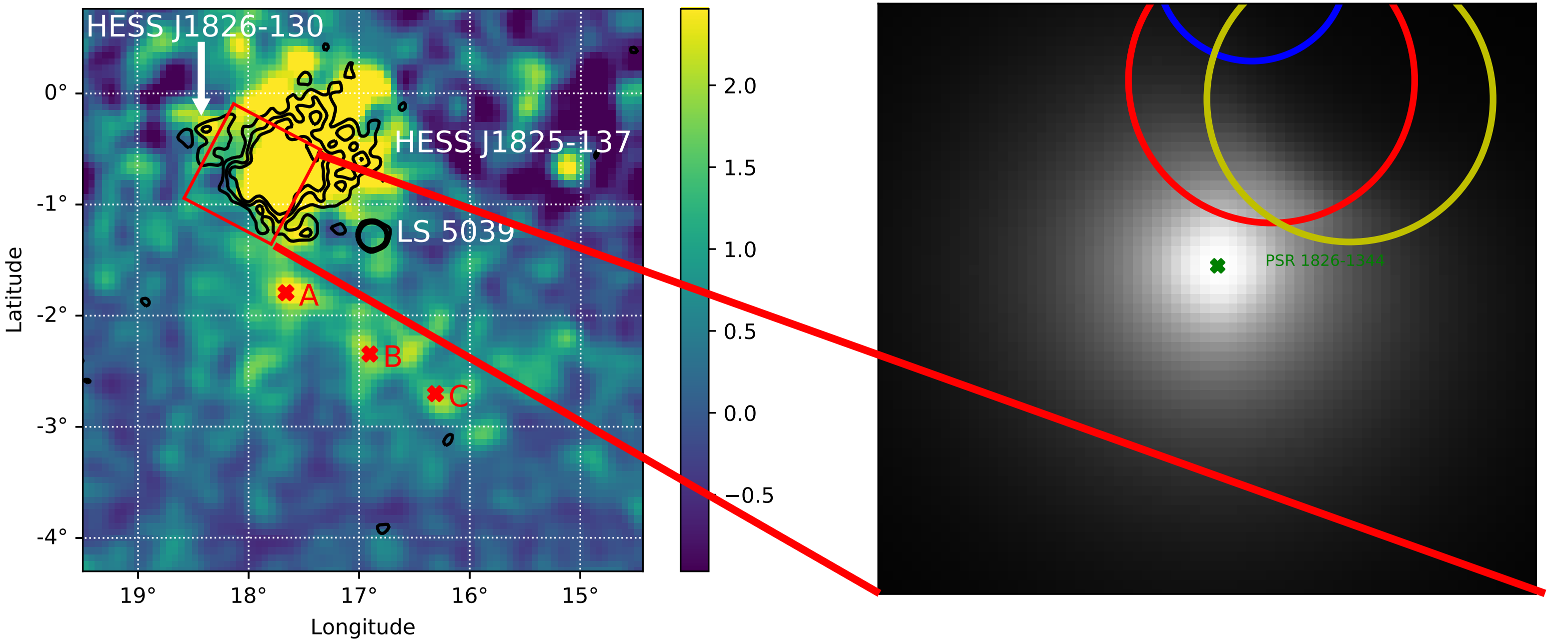
Modelling the gamma-ray emission towards HESS J1825-137

Tiffany Collins

- Multizone Modelling involves solving the diffusion transport equation over a 3D grid of varying ISM density and magnetic field.
- This can predict what the future Cherenkov Telescope Array will see.
- Currently modelling the background ISM and pulsar magnetic field towards HESS J1825-137 to explain gamma-ray emission of HESS J1826-130 and GeV-ABC.



Inverse Compton and Bremsstrahlung emission between 1-10 TeV.

Understanding the TeV Cosmic-Ray “Sea”

Peter Marinos

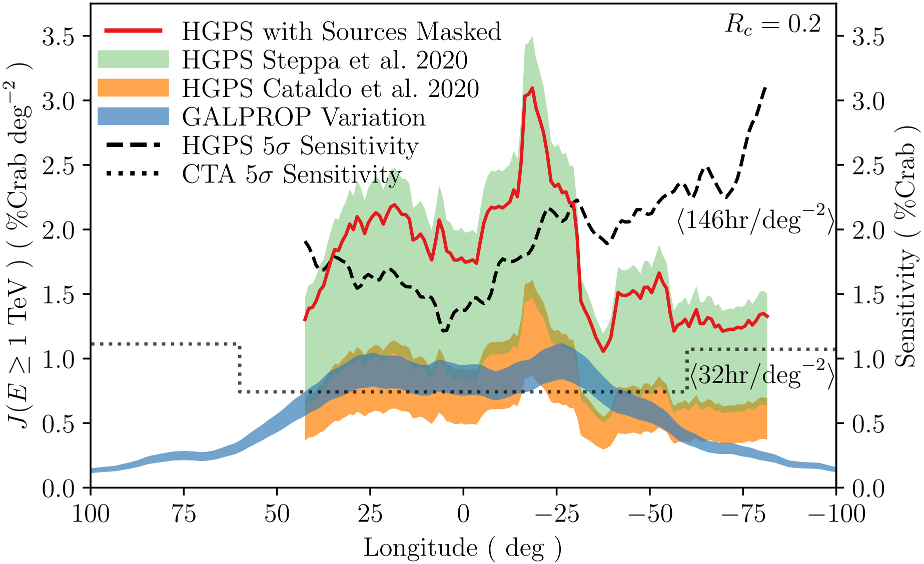
April 2021

The University of Adelaide
Peter MARINOS, A. Prof. Gavin ROWELL and Dr. Troy A. PORTER

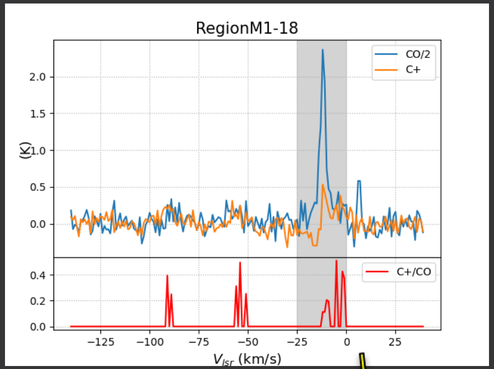
The TeV Diffuse Emission

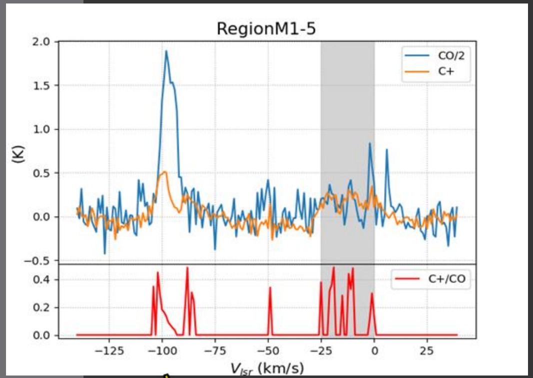
- The H.E.S.S. Galactic Plane Survey (HGPS) includes 2673 hours of γ-rays above 1 TeV, covering $250^\circ \leq l \leq 65^\circ$ and $b \leq |3^\circ|$ (H.E.S.S. Collaboration et al 2018)
- Accurate models of the sea are required to discern the dimmest sources from background emission
- GALPROP numerically solves the transport equation, propagating CRs though the galaxy, and creates γ-ray skymaps (Porter et al. 2020)
- We compare the TeV results from GALPROP to the HGPS observations
- Created a longitudinal profile of both data sets using a sliding averaging window of width 15°, including latitudes $-1.5^\circ < b < +1.0^\circ$

Current Results



Adnaan Thakur
Study of Ionised Carbon towards SNR RXJ 1713.7-3946





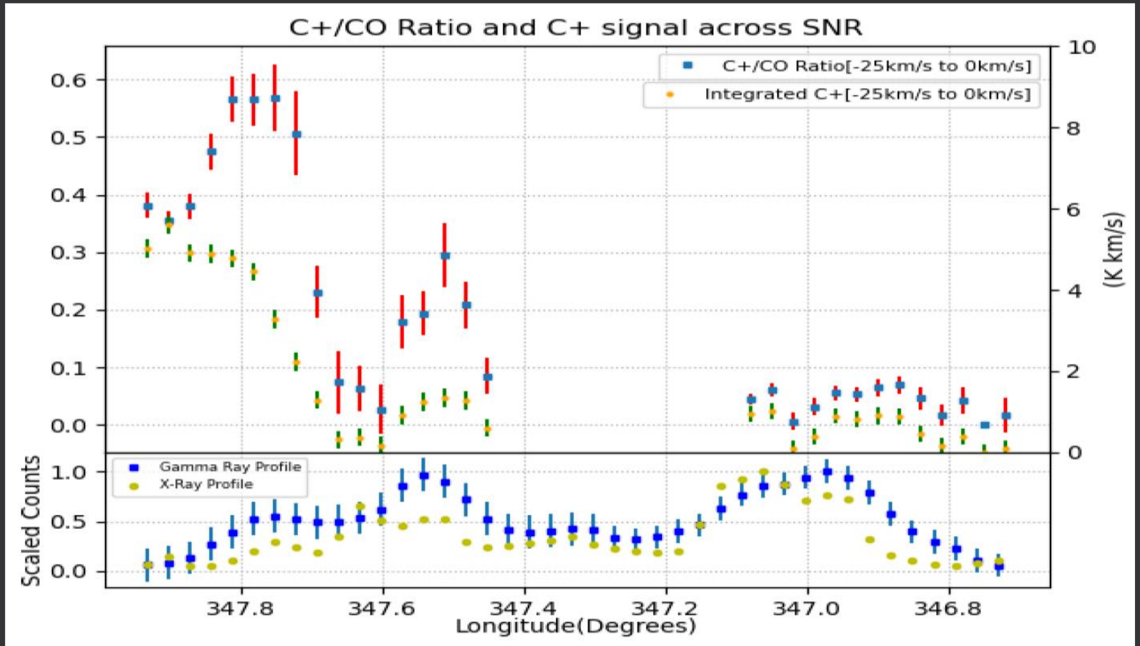
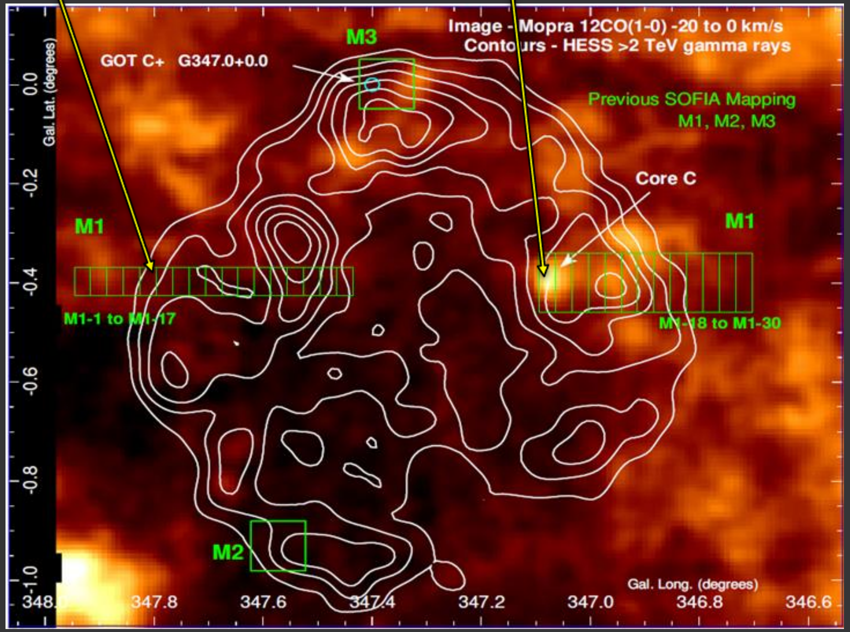


Figure 3.5: The distribution of C+/CO ratio and C+ signal across the SNR. The lower plot is the profile of gamma ray and X-ray counts across remnant over the same regions as the C+ M1 mapping.



- The C+ data was taken from the SOFIA Telescope, mapped across the SNR and regions to the north and south
- C+/CO ratio could identify regions of potentially high cosmic ionisation