Predicting Neutrino Emission for the Sources in the H.E.S.S. Galactic Plane Survey

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HGPS

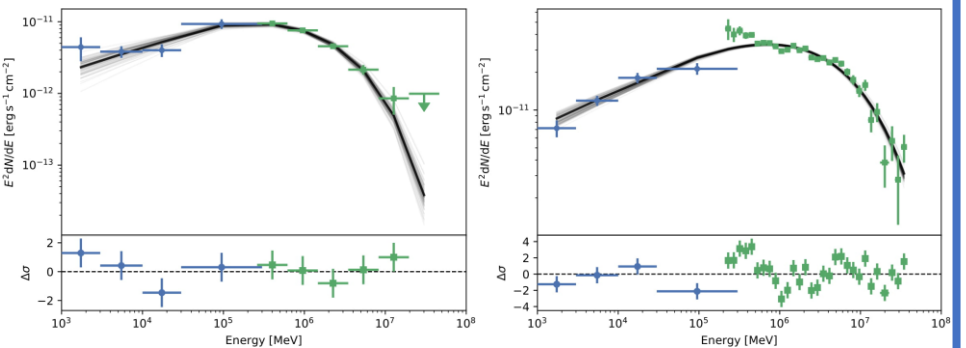
- 78 sources [1]
- 48 unidentified
- Neutrino emission from the unidentified sources would indicate that the emission is hadronic.

Parametrising HESS J1640-465 and HESS J1713-395

- Left: HESS J1640-465 and 4FGL J1640.6-4632
- Right: HESS J1713-395 and 4FGL J1713.5-3945e
- Best fit line is the black line
- Gray lines are the other samples in the fitting

χ2 p-value:

- 0.43
- 4.2×10^{-8} (worst of all the sources)



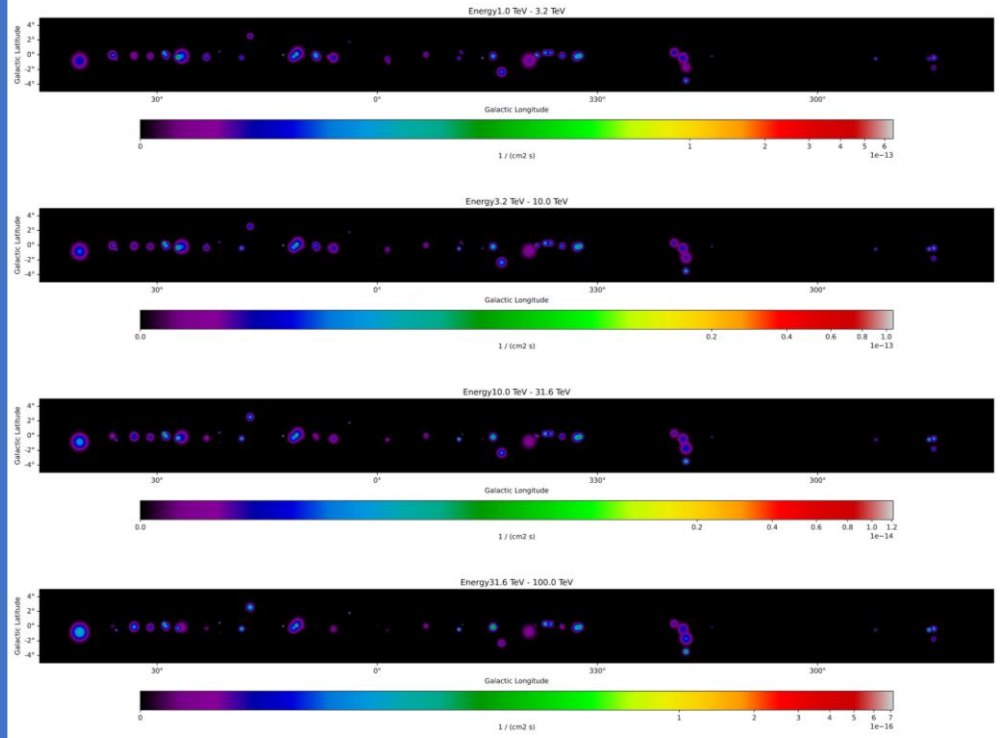
Predicting Neutrino Flux

- All sources assumed to be hadronic
- Known leptonic sources excluded
- Model is solely based on observation and independent of:
  - Distance to source
  - Source class
  - Density of ambient medium
- Parametrisation of proton spectrum naima [9] and the model of Kelner et al [7] based on the gamma-ray spectrum of each source.
- The fitting done with naima [9] uses an affine-invariant ensemble sampler for Markov Chain Monte Carlo.
- Proton spectrum is then used to get a prediction of the neutrino flux.

Creating the Neutrino Map

- 66 sources used
- 19 have a 4FGL [3] counterpart
- Spatial model from HGPS [1]
- Spectral model is the muon neutrino part of our model based on [7]
- The map is populated by integrating the neutrino flux over the energy bin
- Neutrino map is split into 4 energy bins from 1 TeV to 100 TeV
- Map created using gammapy [5,8]
- This map could be used to fit neutrino data

Neutrino Map



Bibliography

[1] H.E.S.S. Collaboration In: A&A 612, A1 (2018)
[2] H.E.S.S. Collaboration In: Phys. Rev. D, 90:122007 (2014)
[3] Fermi/LAT Collaboration In: ApJ, 892(2):105 (2020)
[4] Tibet ASγ Collaboration In: Phys. Rev. Lett., 126:141101 (2021)
[5] C. Deil, et al. In: ICRC2017, volume 301, page 766 (2017)
[6] E. Kafexhiu, et al. In: Phys. Rev. D, 90:123014 (2014)
[7] S.R. Kelner, et al. In: Phys. Rev. D, 74:034018 (2006)
[8] C. Nigro, et al. In: A&A 625, A10 (2019)
[9] V. Zabalza In: Proc. of International Cosmic Ray Conference 2015, page 922 (2015)