

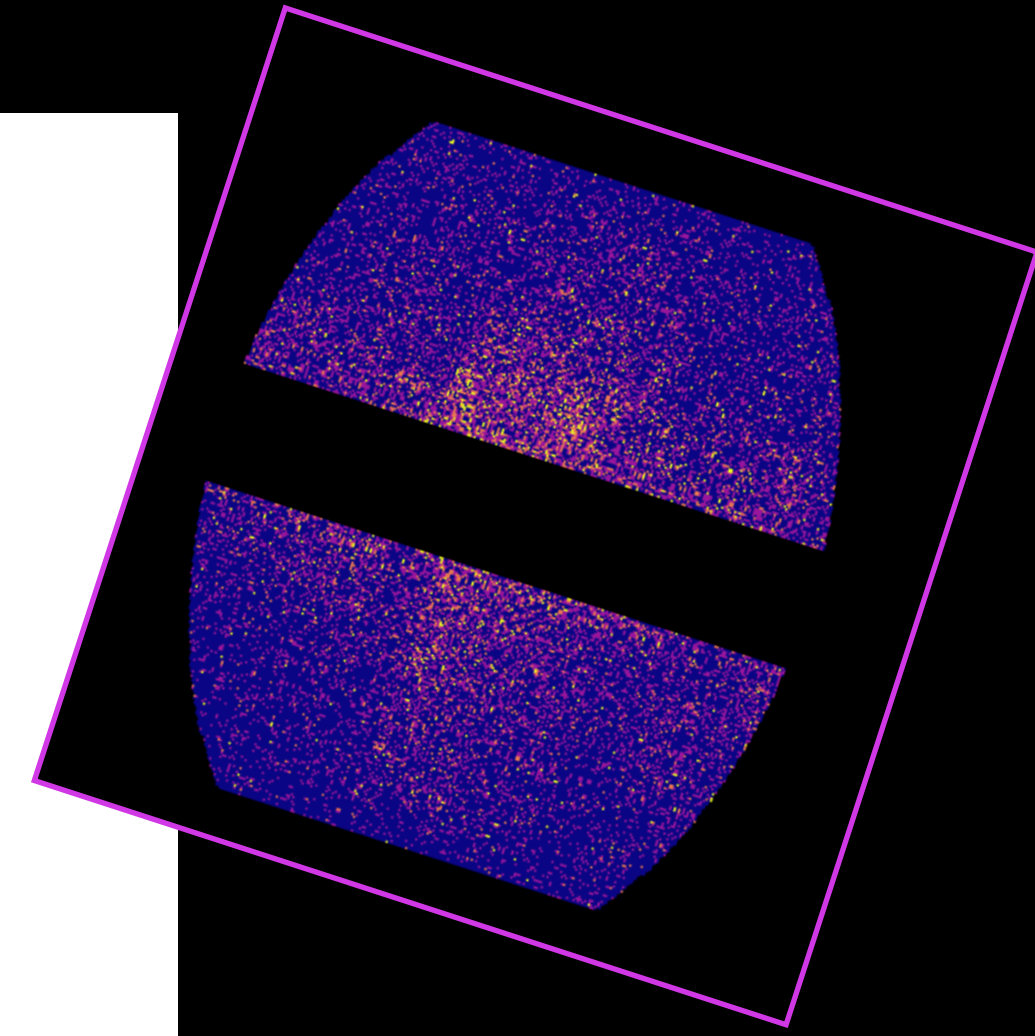
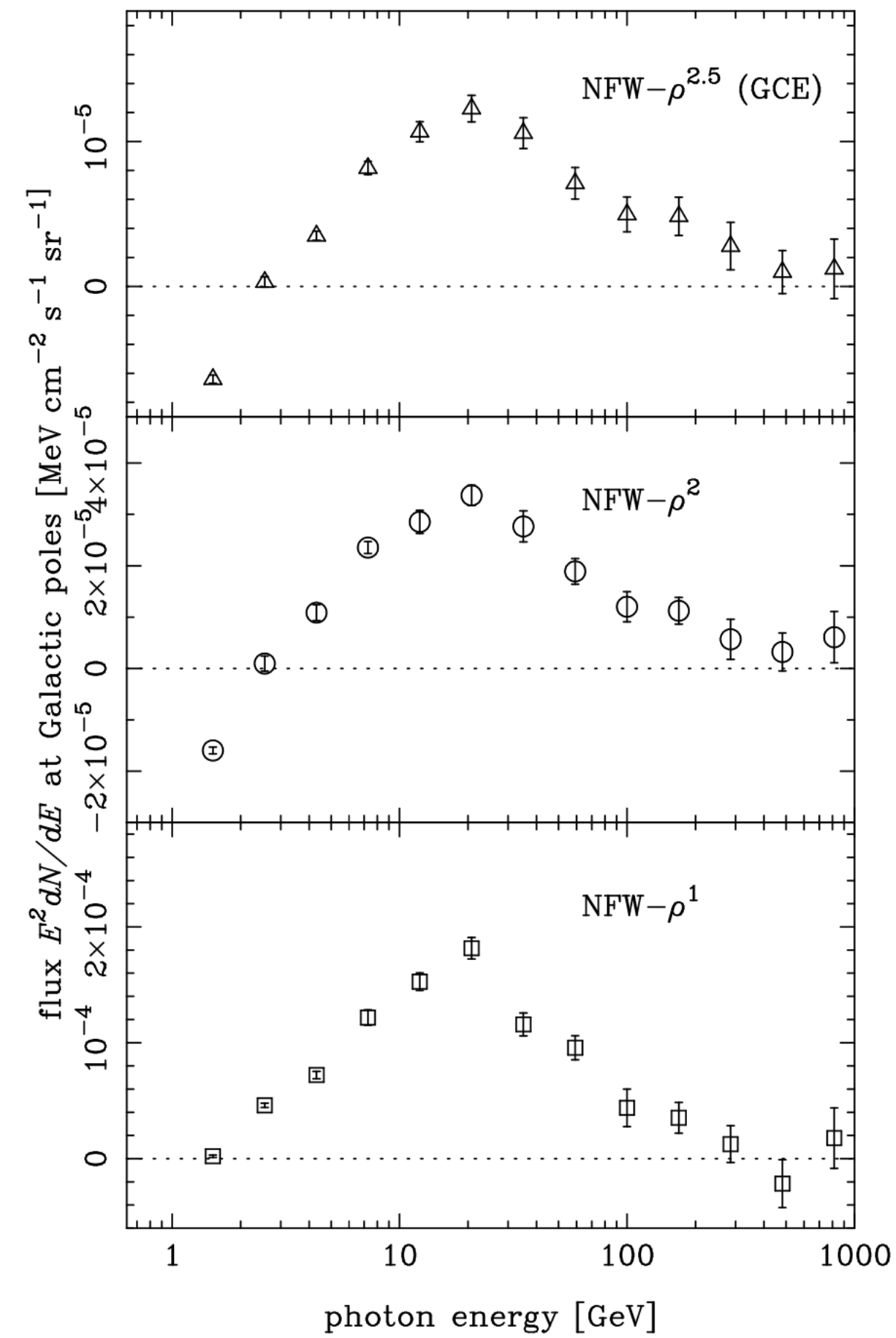
STRESS TESTING THE 20GEV EXCESS



Eve Schoen | May 12th, 2026 | Pheno

Collaborators: Joshua Foster, Kailash Raman, Nicholas Rodd, Benjamin Safdi

THE EXCESS



Totoni, T. "20 GeV halo-like excess of the Galactic diffuse emission and implications for dark matter annihilation." Nov 2025. arXiv:2507.07209.

← OUTLINE →

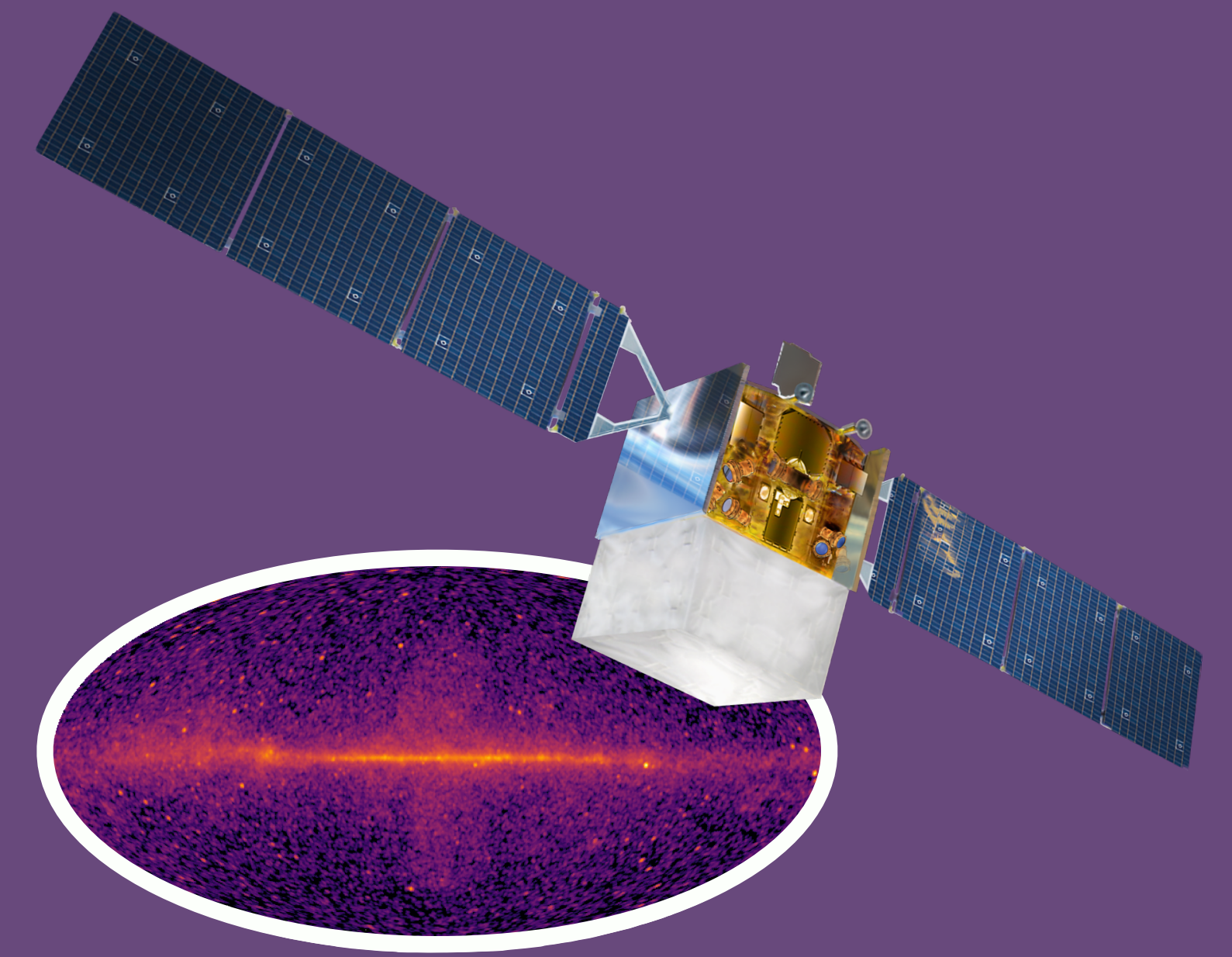
1. What is the excess?

2. What methods were used to discover it?

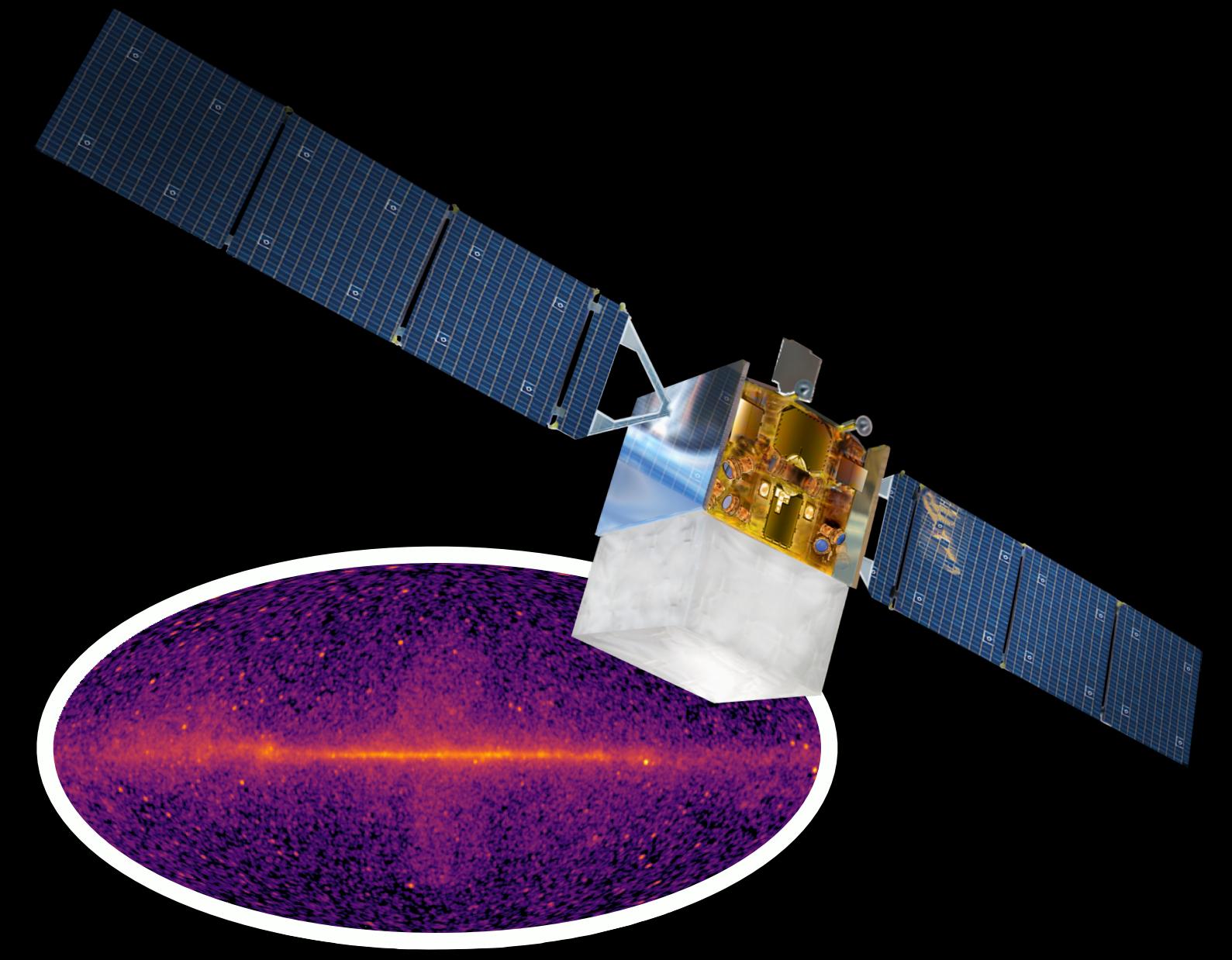
3. Is it real?

4. If the signal is real, then why are we still skeptical that it is dark matter?

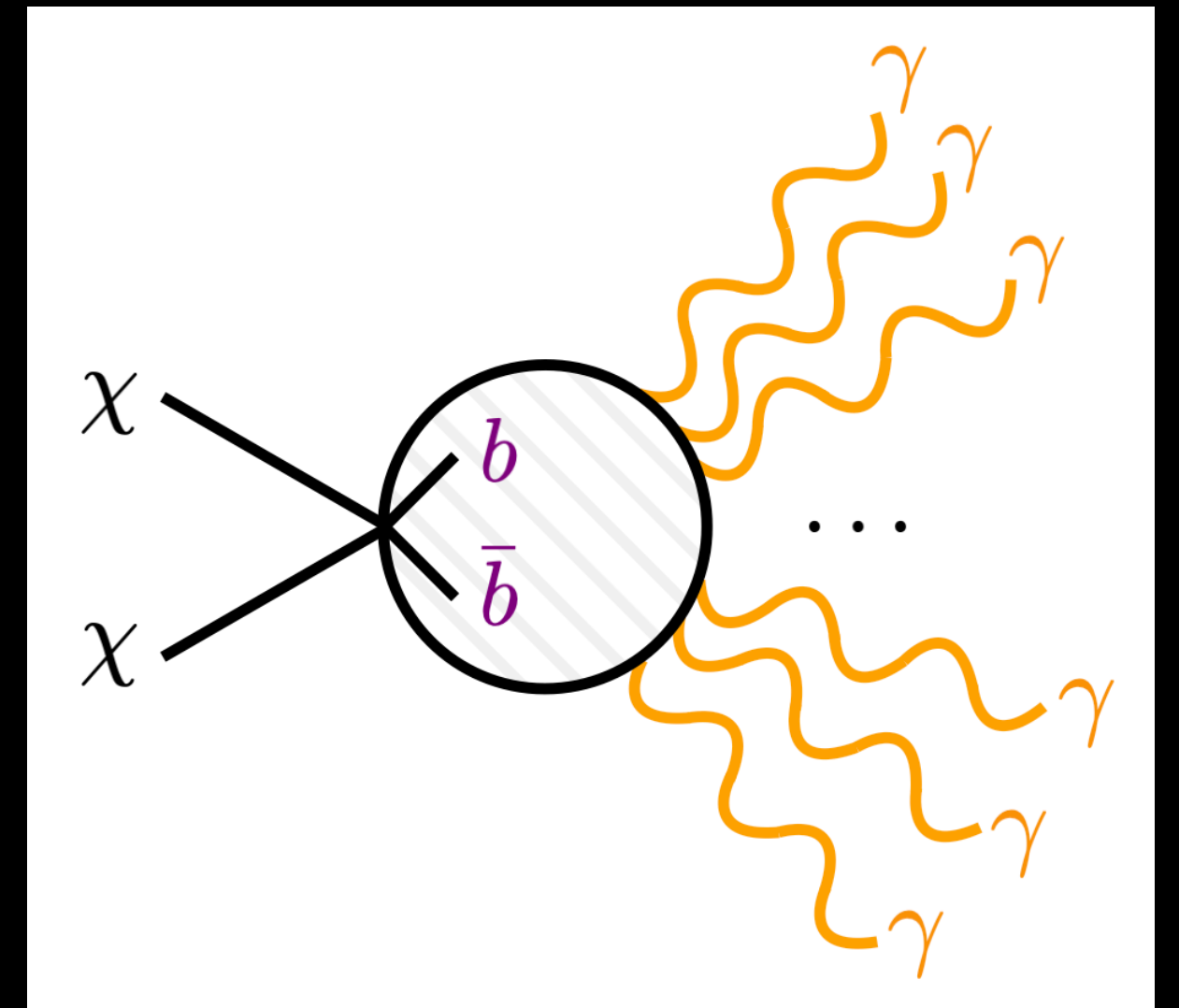
5. Does the excess robustly pass as a dark matter signal?



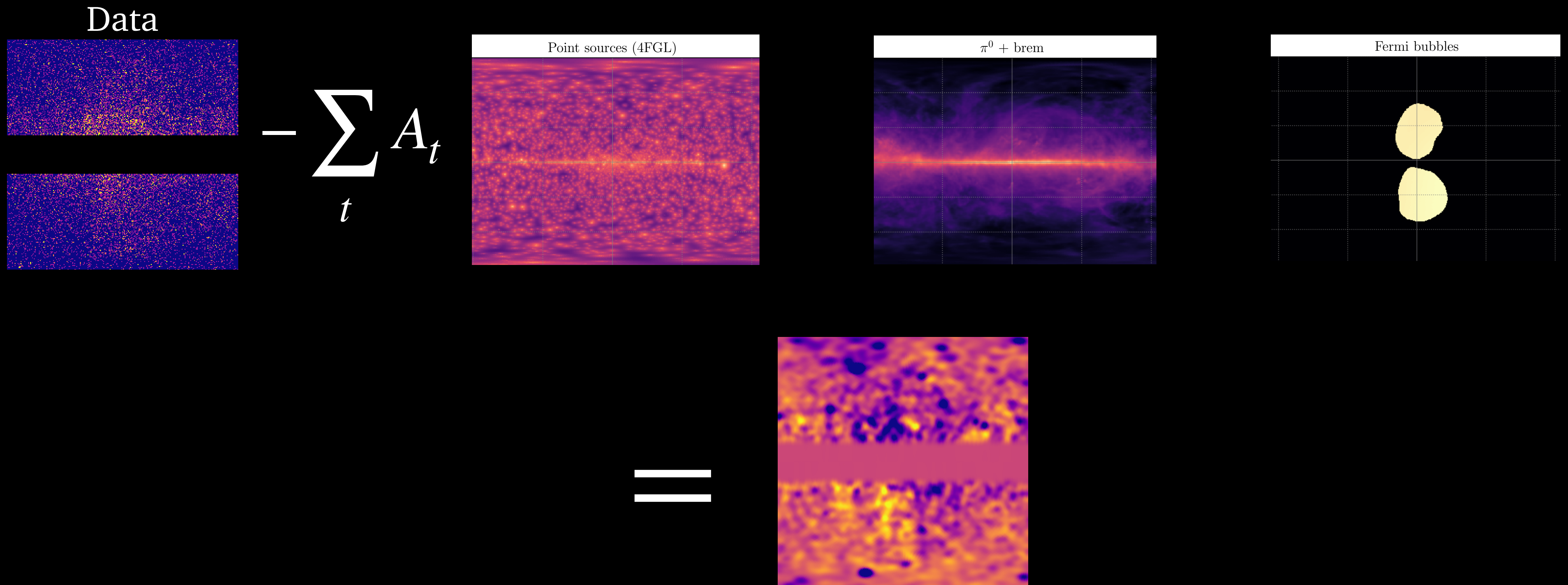
FERMI-LAT EXCESS DETECTOR



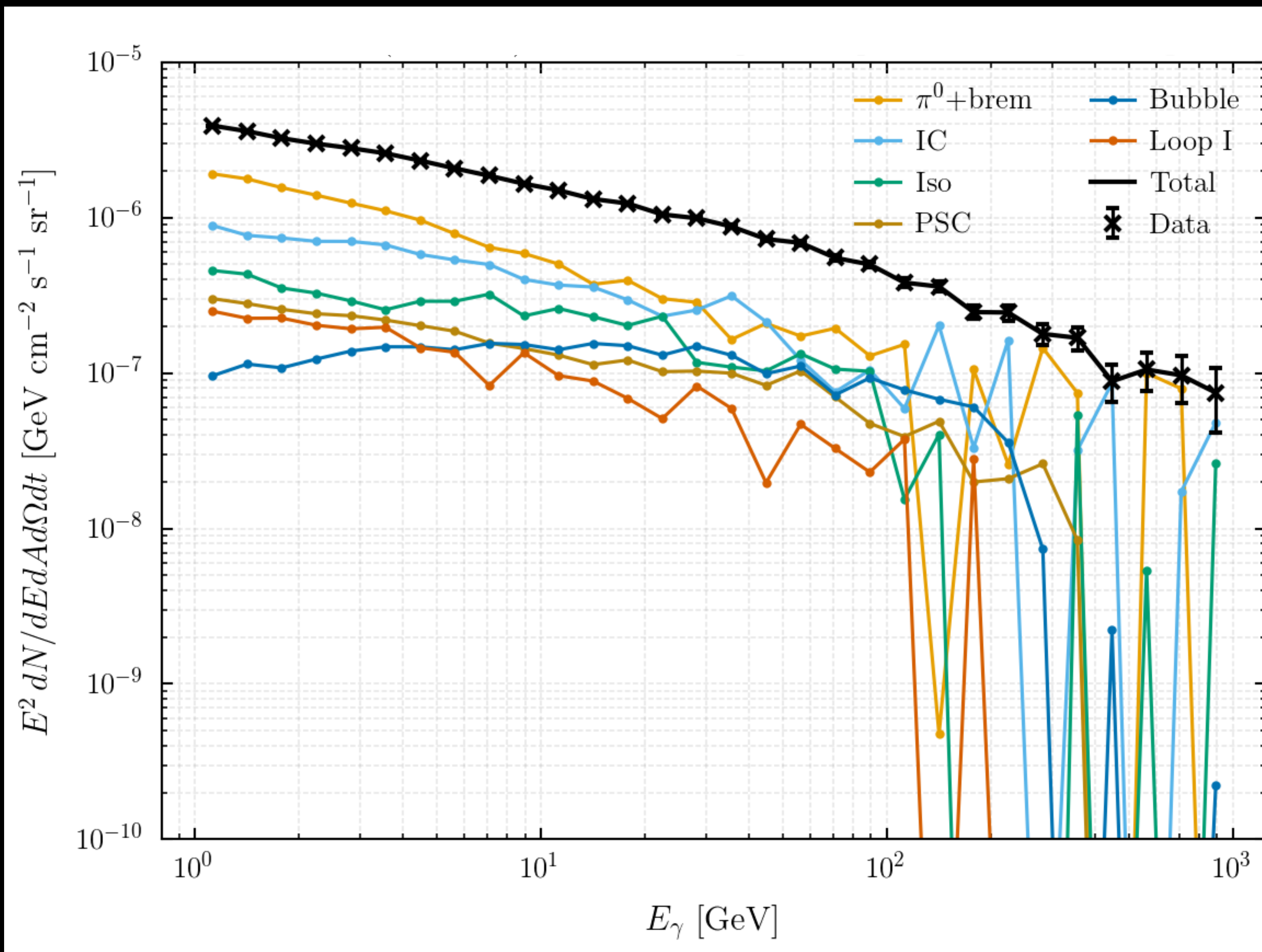
- * Launched in 2008 - 16 years of data now
- * All sky survey - good for dark matter
- * γ 's from 20 MeV to >300 GeV



TECHNIQUES : TEMPLATES FITTING

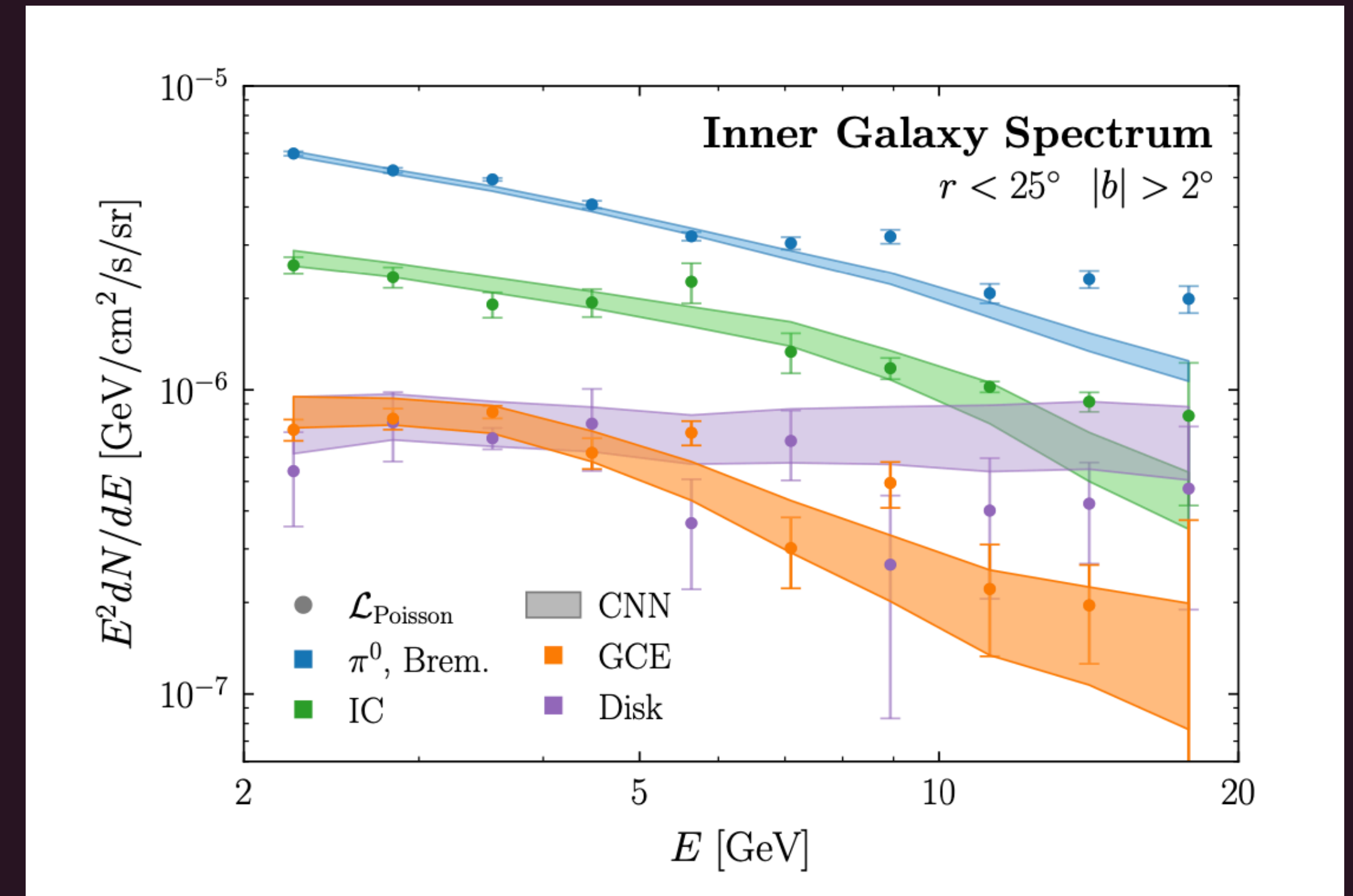


TECHNIQUES : TEMPLATE FITTING



THE GALACTIC CENTER EXCESS

- ✱ Discovered 2009 shortly after Fermi-LAT data released
- ✱ Expected location for strongest DM signal
- ✱ Something I am excited about!
(arXiv:2507.17804)



Florain List, Yujin Park, Nicholas Rodd, E.S., Florian Wolf.
"On the Energy Distribution of the Galactic Center Excess'
Source." Jul 2025.

← OUTLINE →

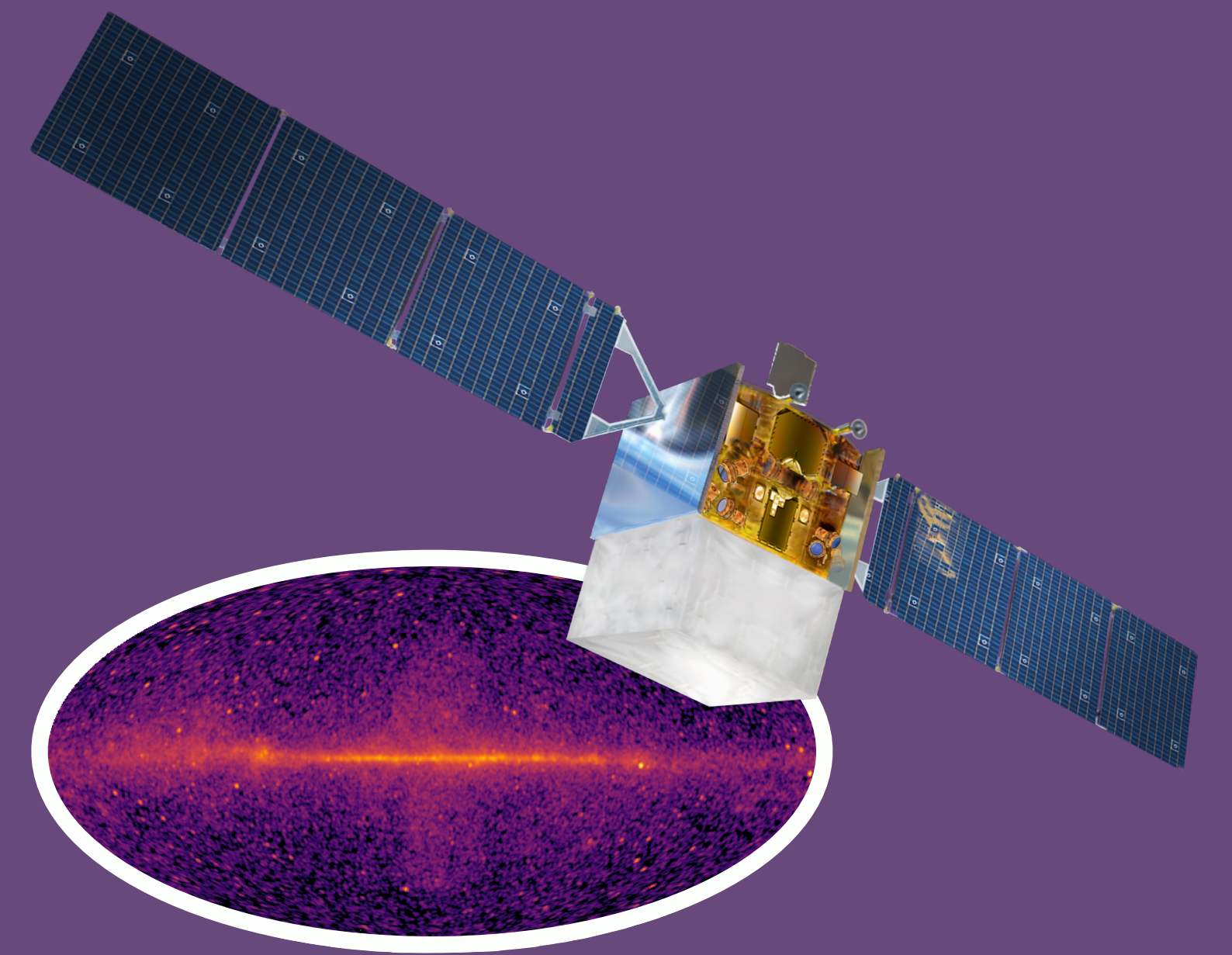
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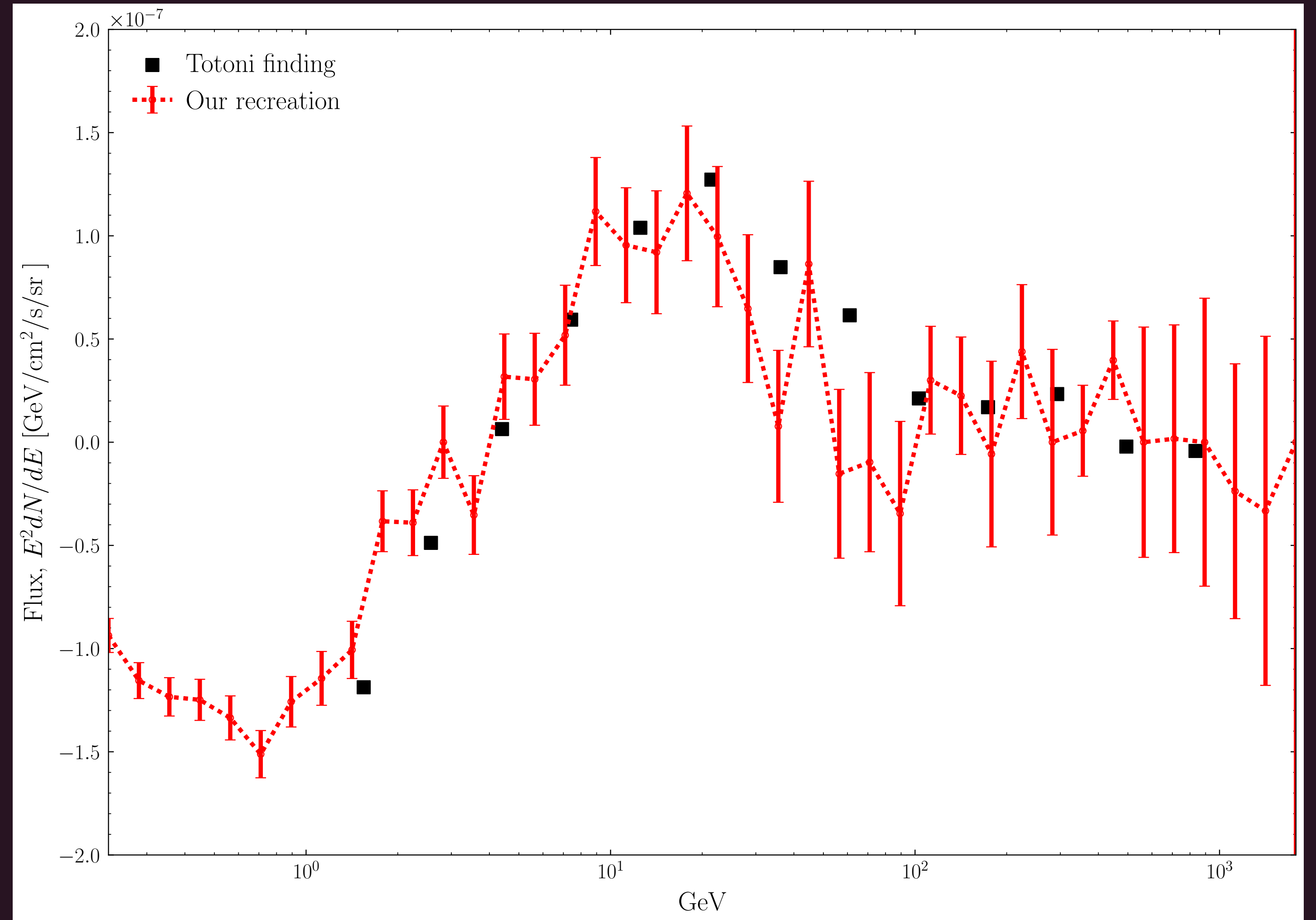
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THE EXCESS.



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- ✱ Flat Fermi bubbles template
(already included in appendix)
- ✱ High resolution: pixel size
 $10^\circ \times 10^\circ \rightarrow 0.46^\circ \times 0.46^\circ$
- ✱ Global optimization
- ✱ No negative normalization of
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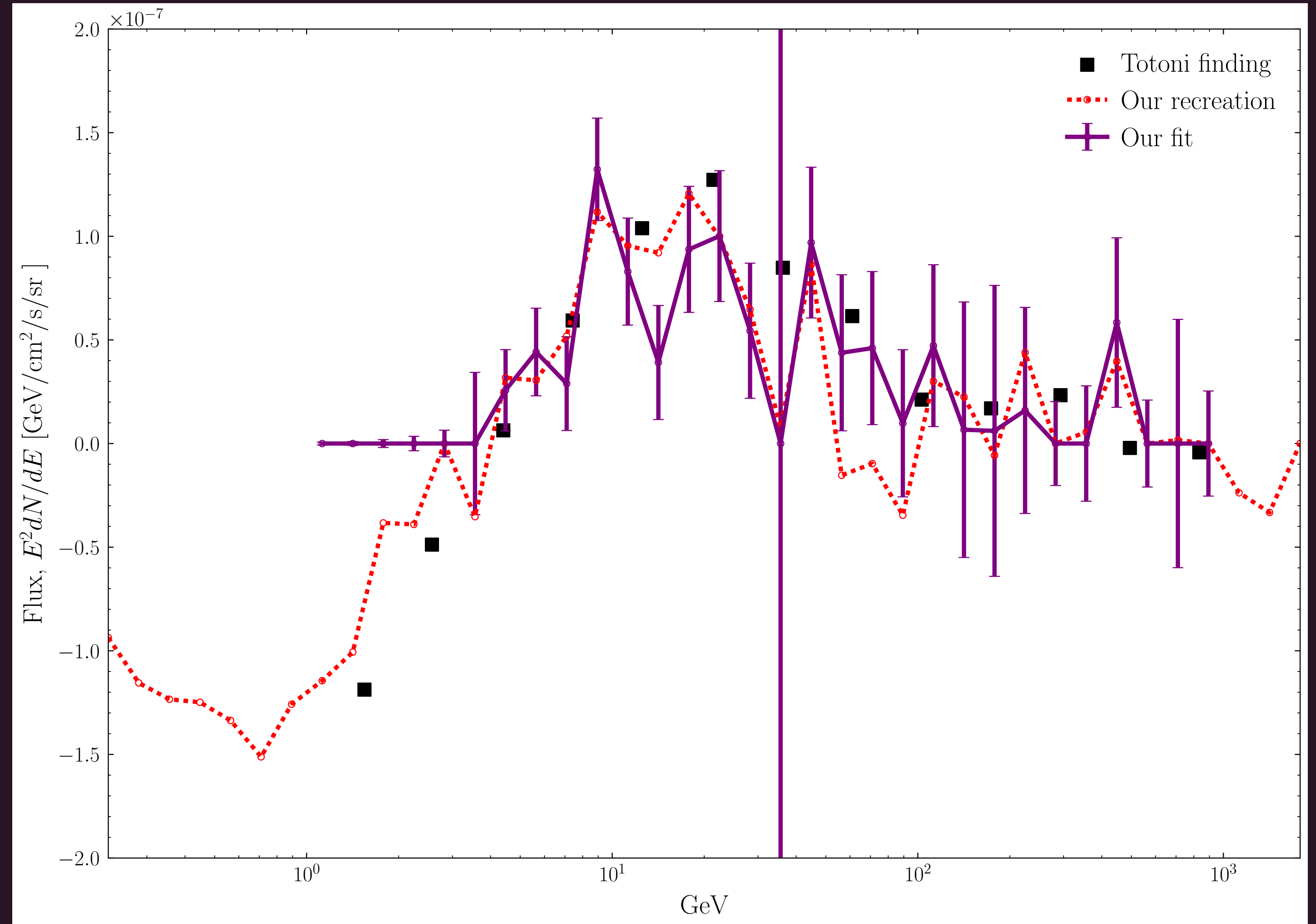
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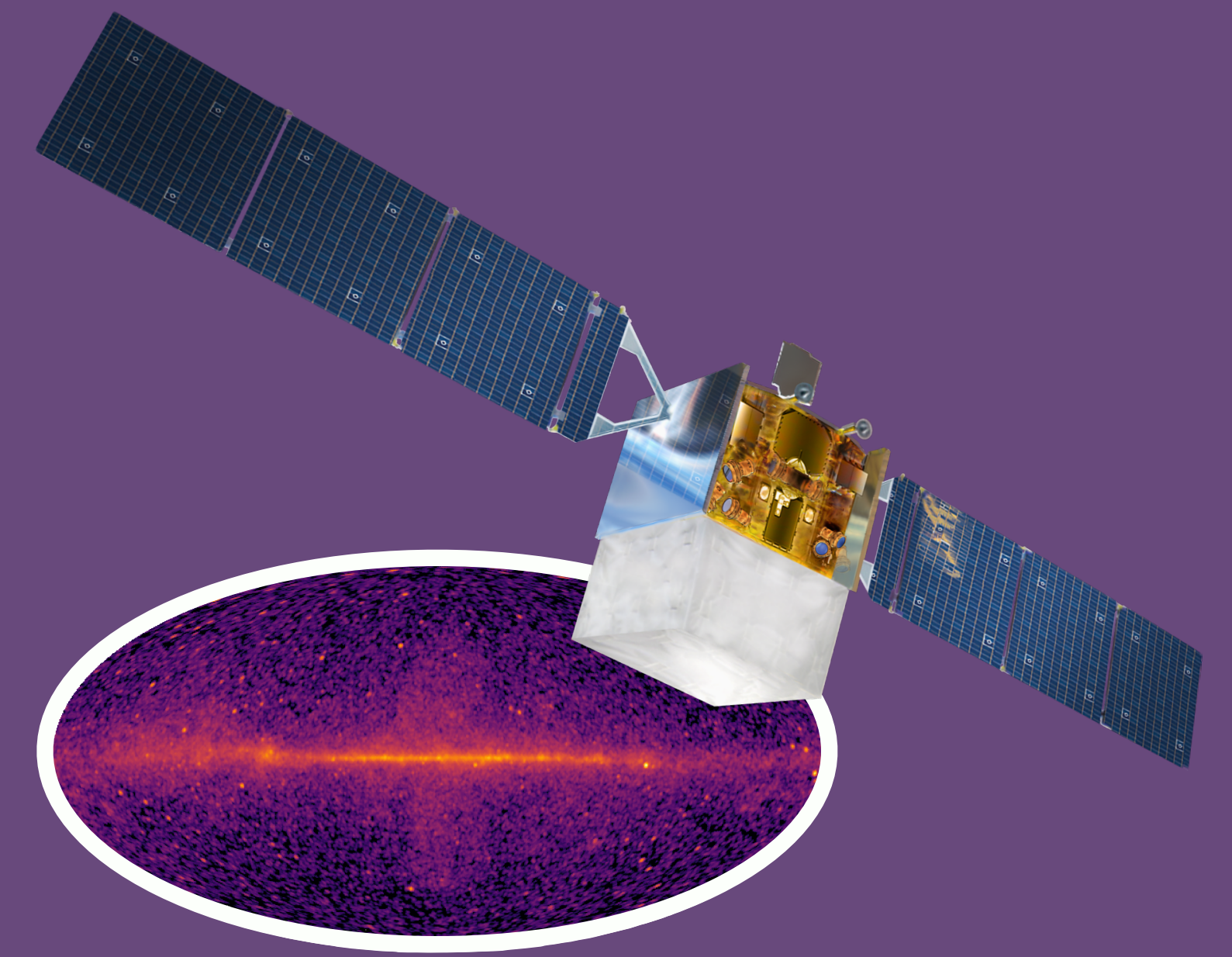
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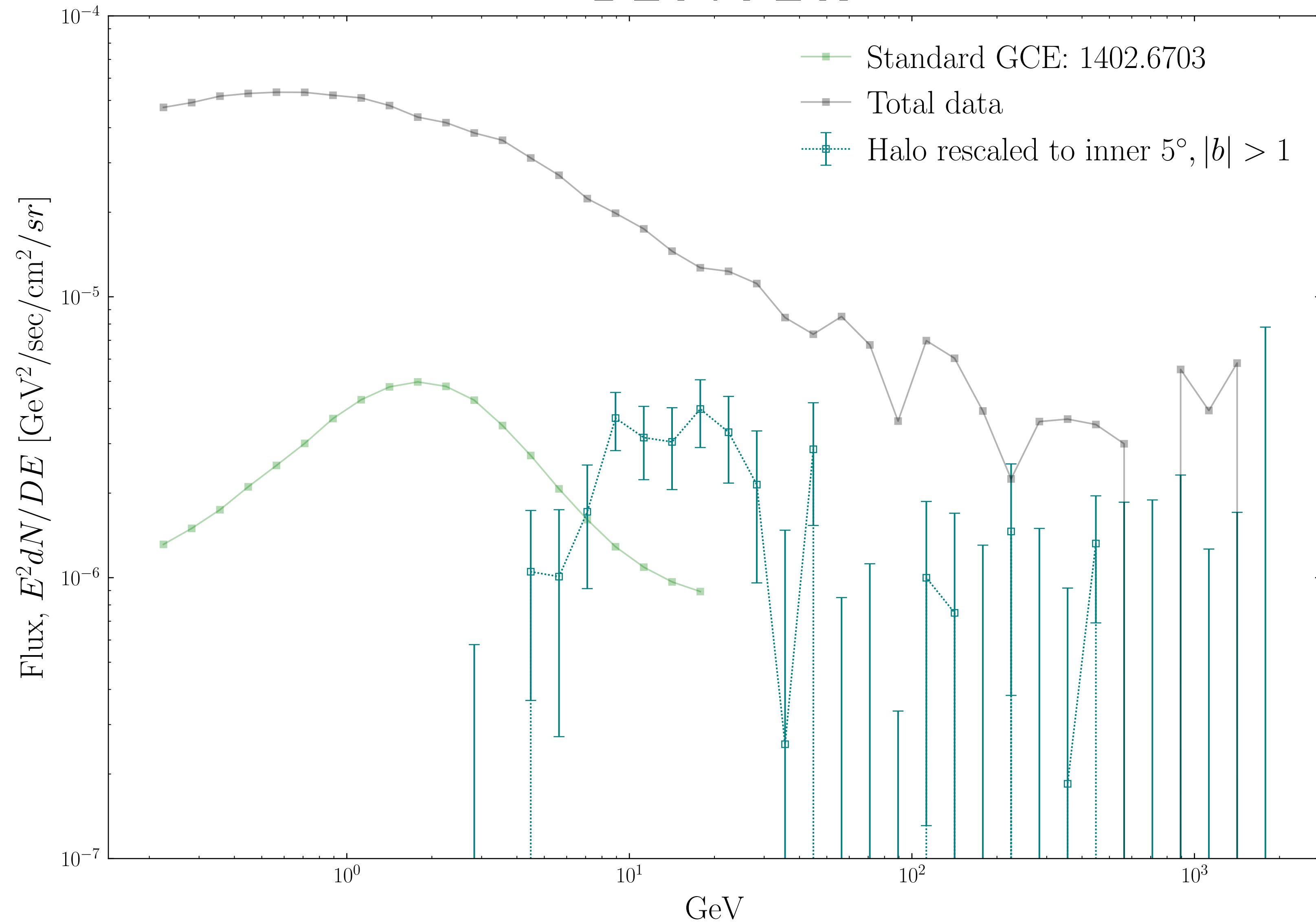


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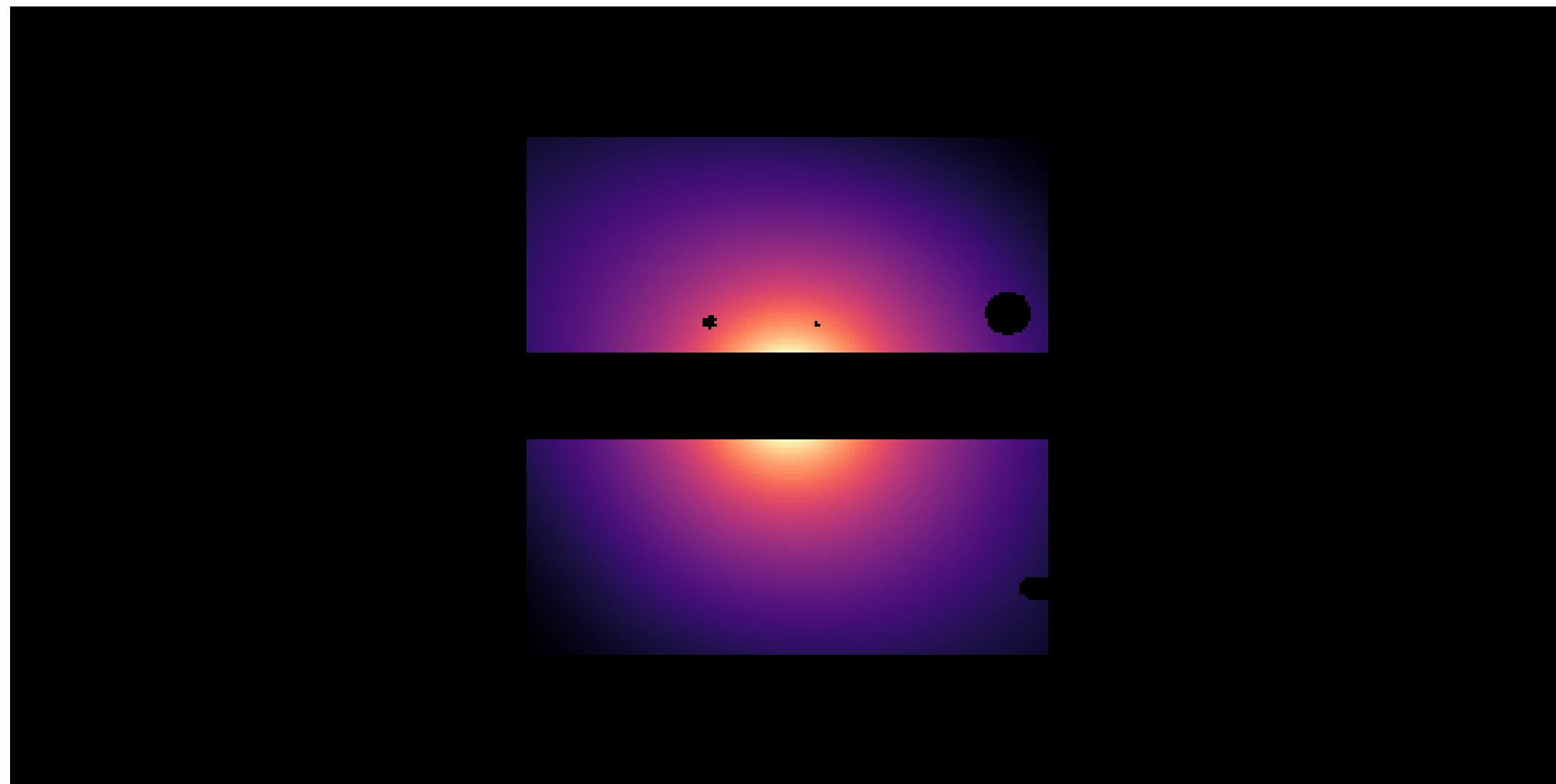


EXTRAPOLATING THE EXCESS TO THE GALACTIC CENTER

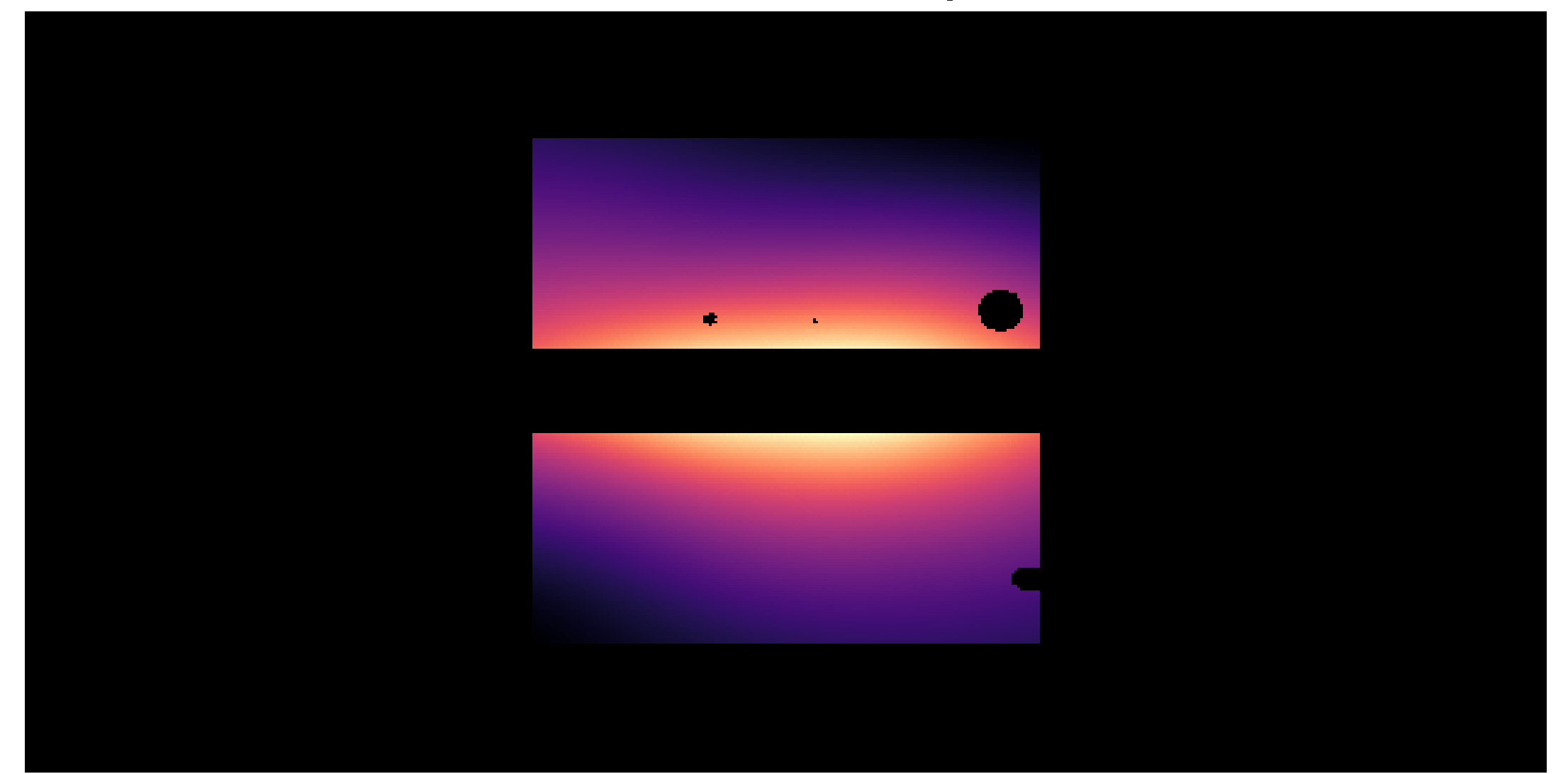


A TRICKY ROI

Halo



Inverse Compton



← OUTLINE →

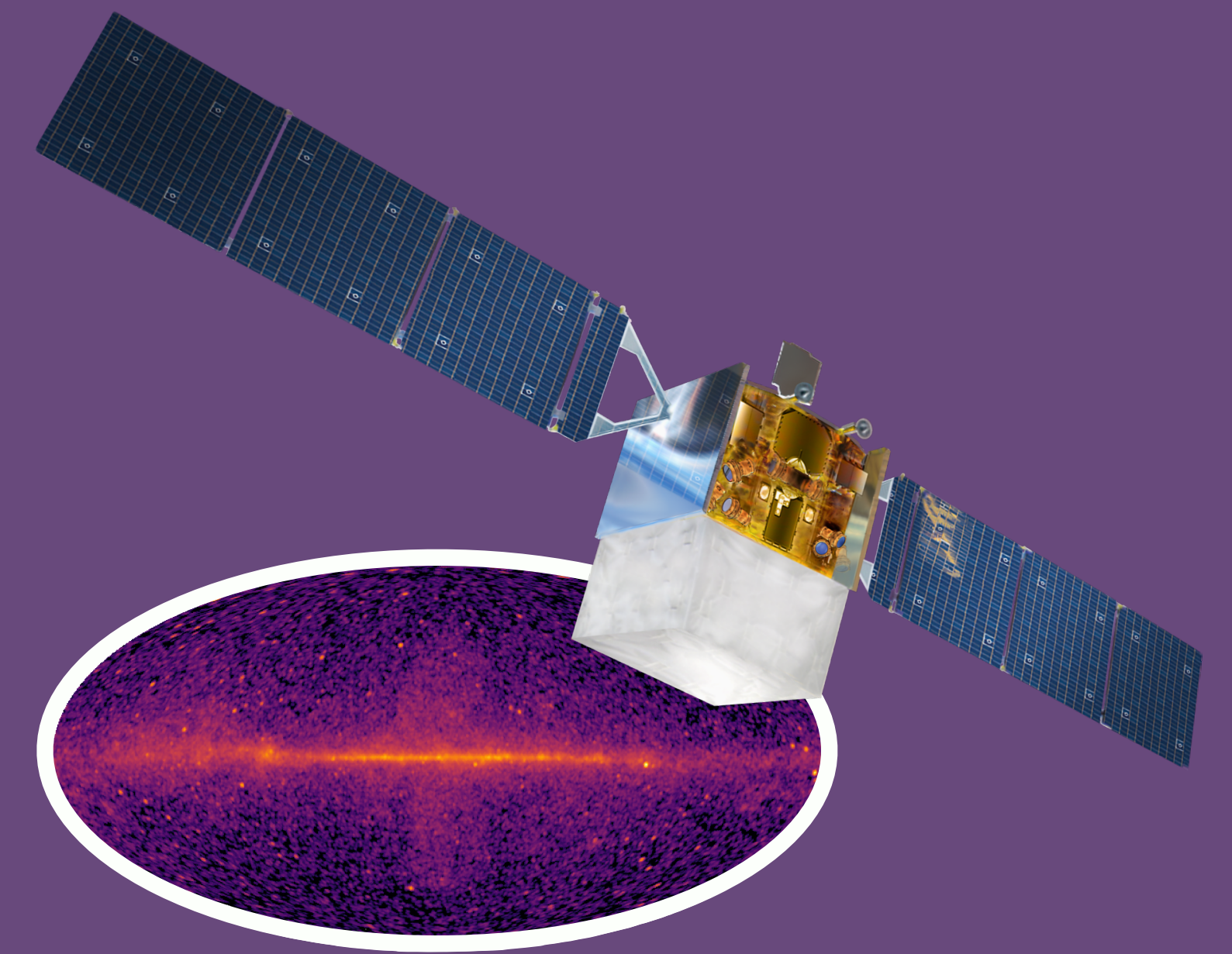
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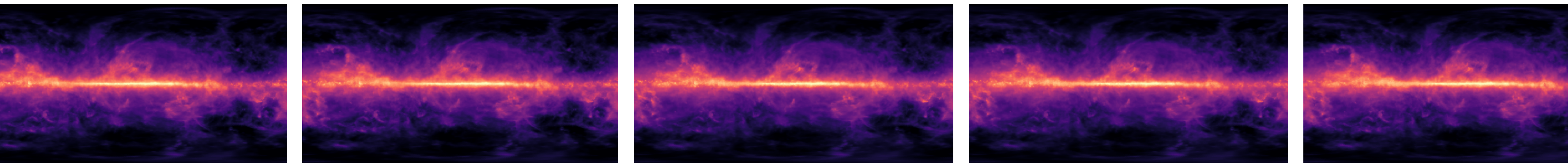
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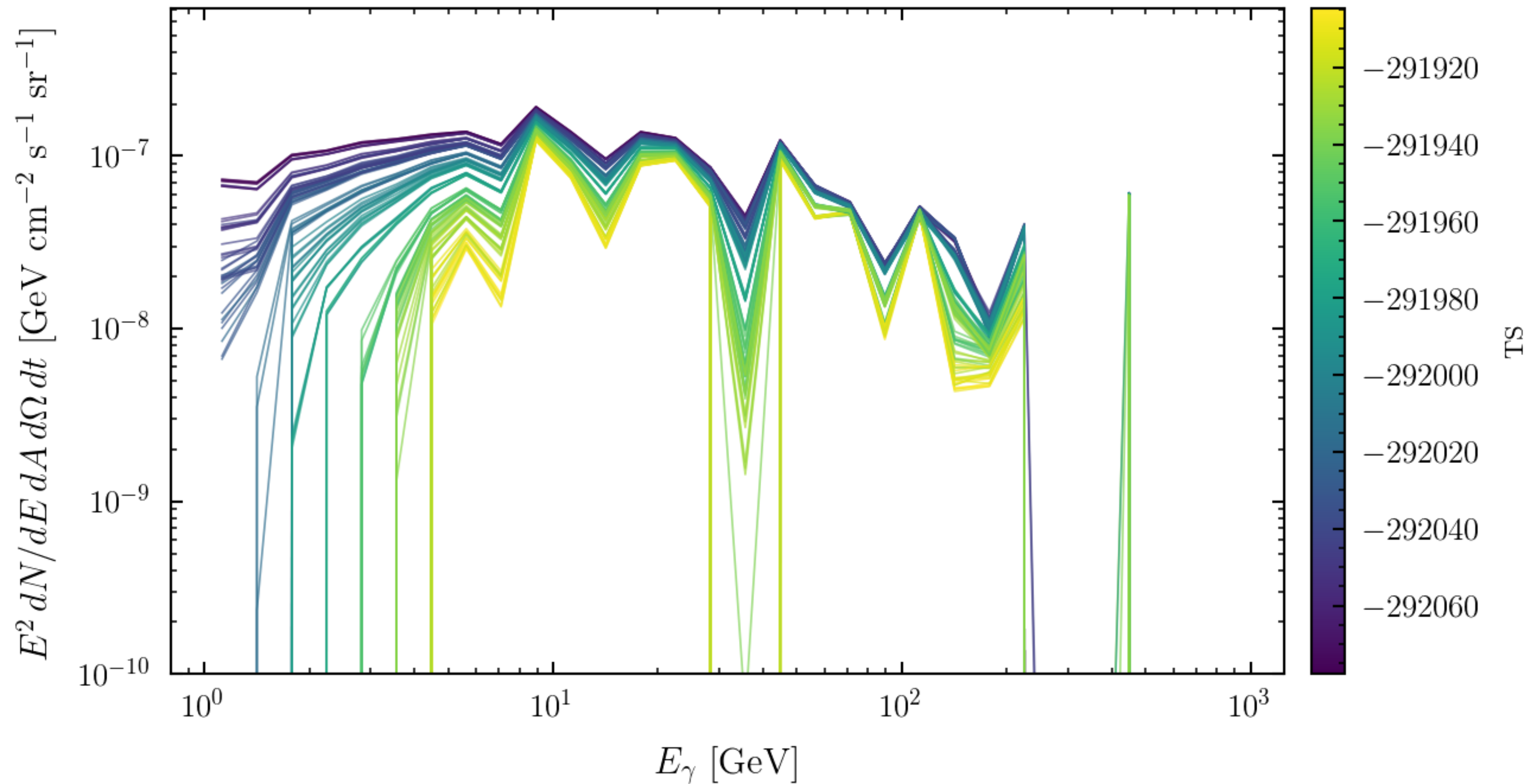


VARYING THE DIFFUSE MODEL

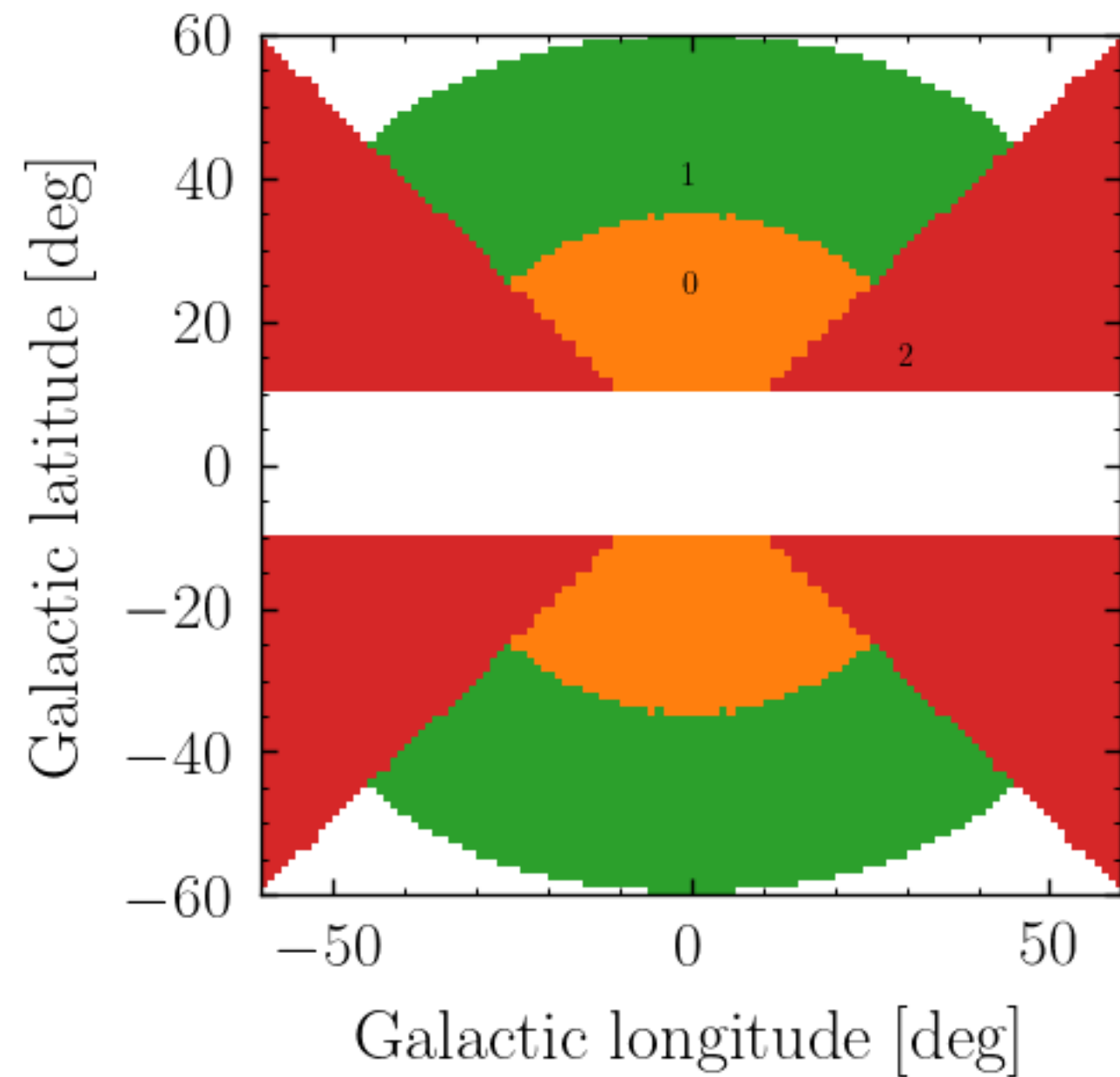
- The diffuse model is the γ 's from cosmic rays interacting with the matter and starlight of the Galaxy
- GALProp self consistently models the distribution of sources of cosmic rays, propagation properties of the MW and maps the dust
- It has many tunable parameters, for ex, cosmic ray source distribution and confinement boundaries, 21 cm spin temperature, ect.



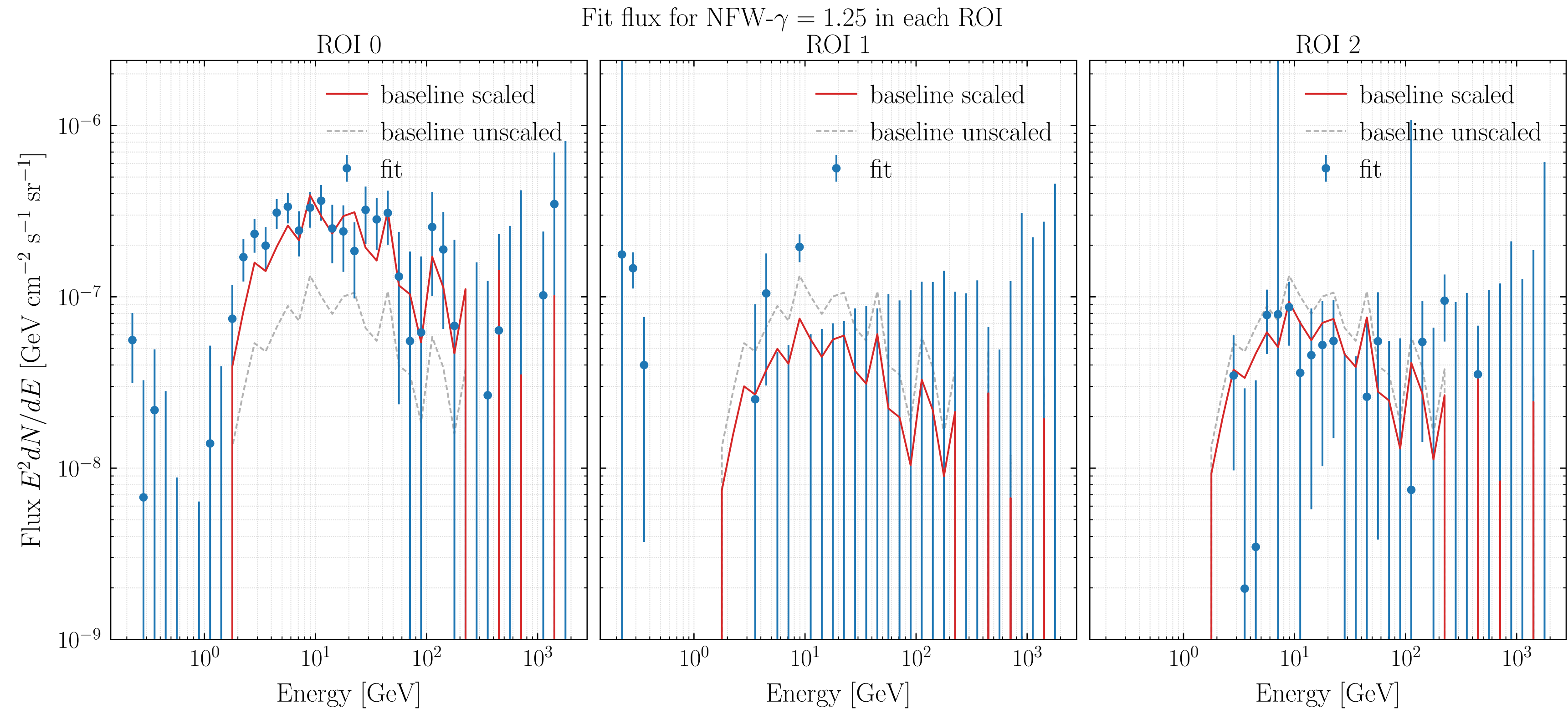
ROBUSTNESS OF SIGNAL SPECTRA



SIGNAL SCALING ACROSS ROIS



Inspired by analysis of Calore, Cholis,
Weniger. 1409.0042

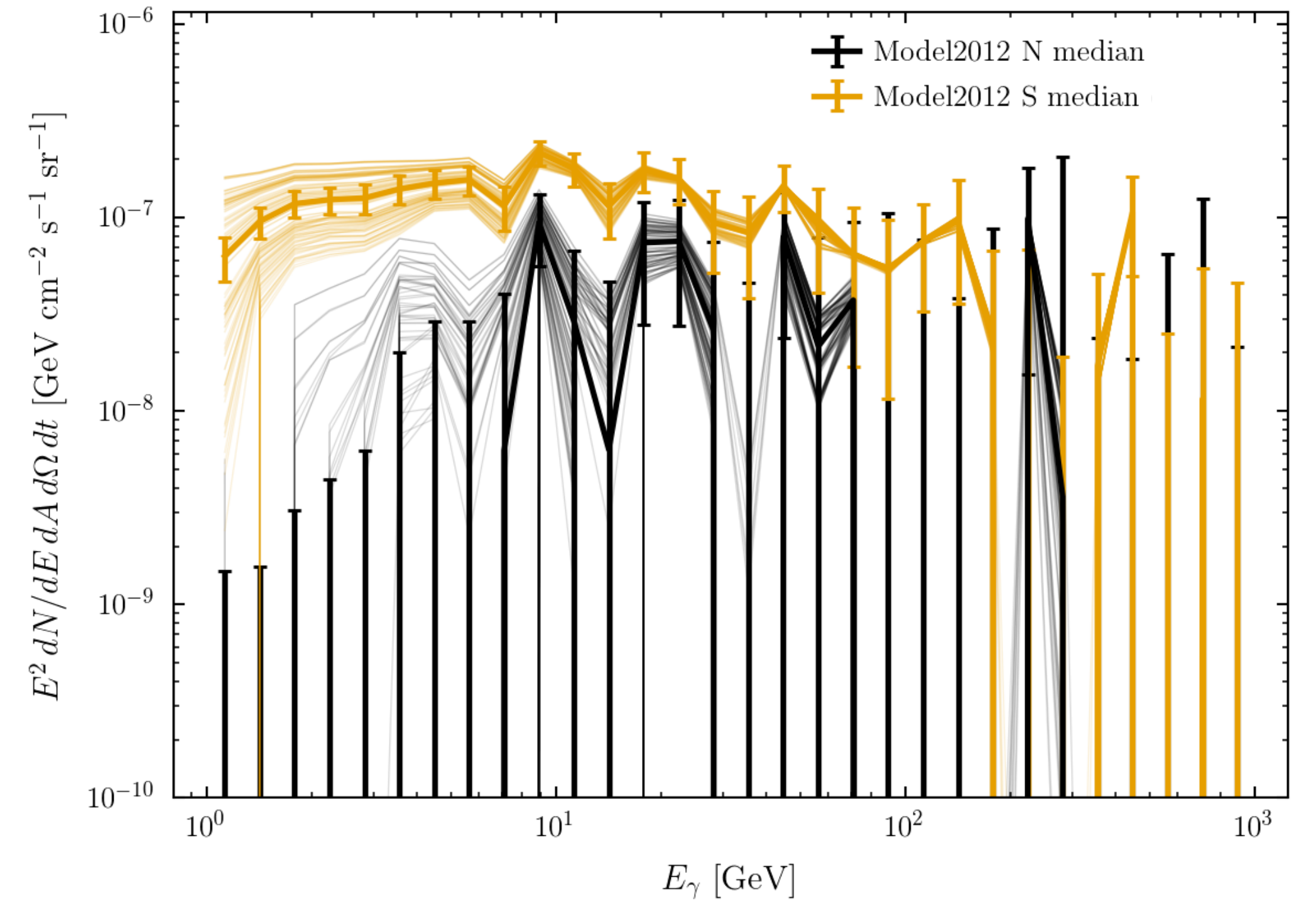
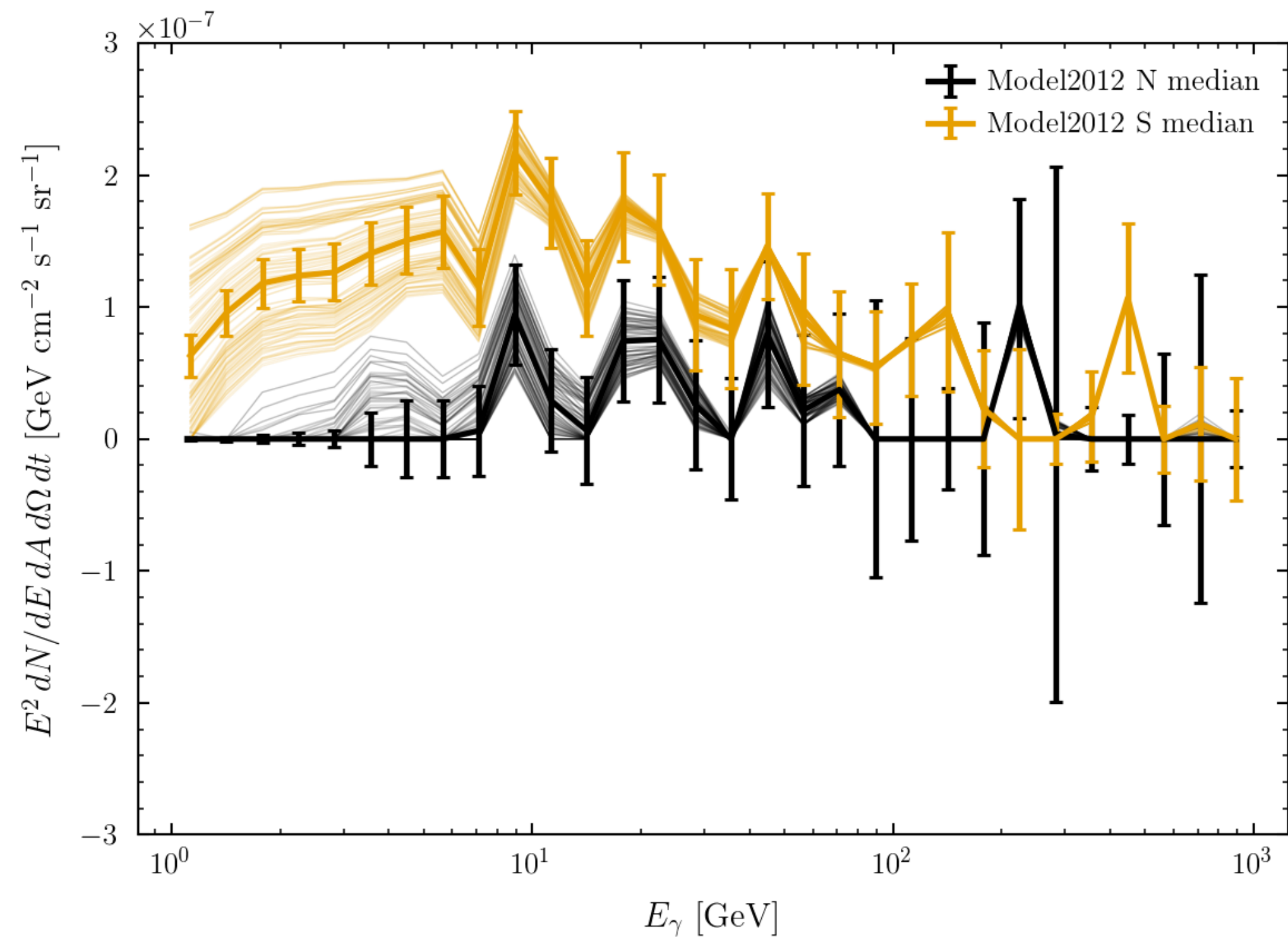


NORTH-SOUTH ASYMMETRY

Residual map, E range 14.2-56.4 GeV

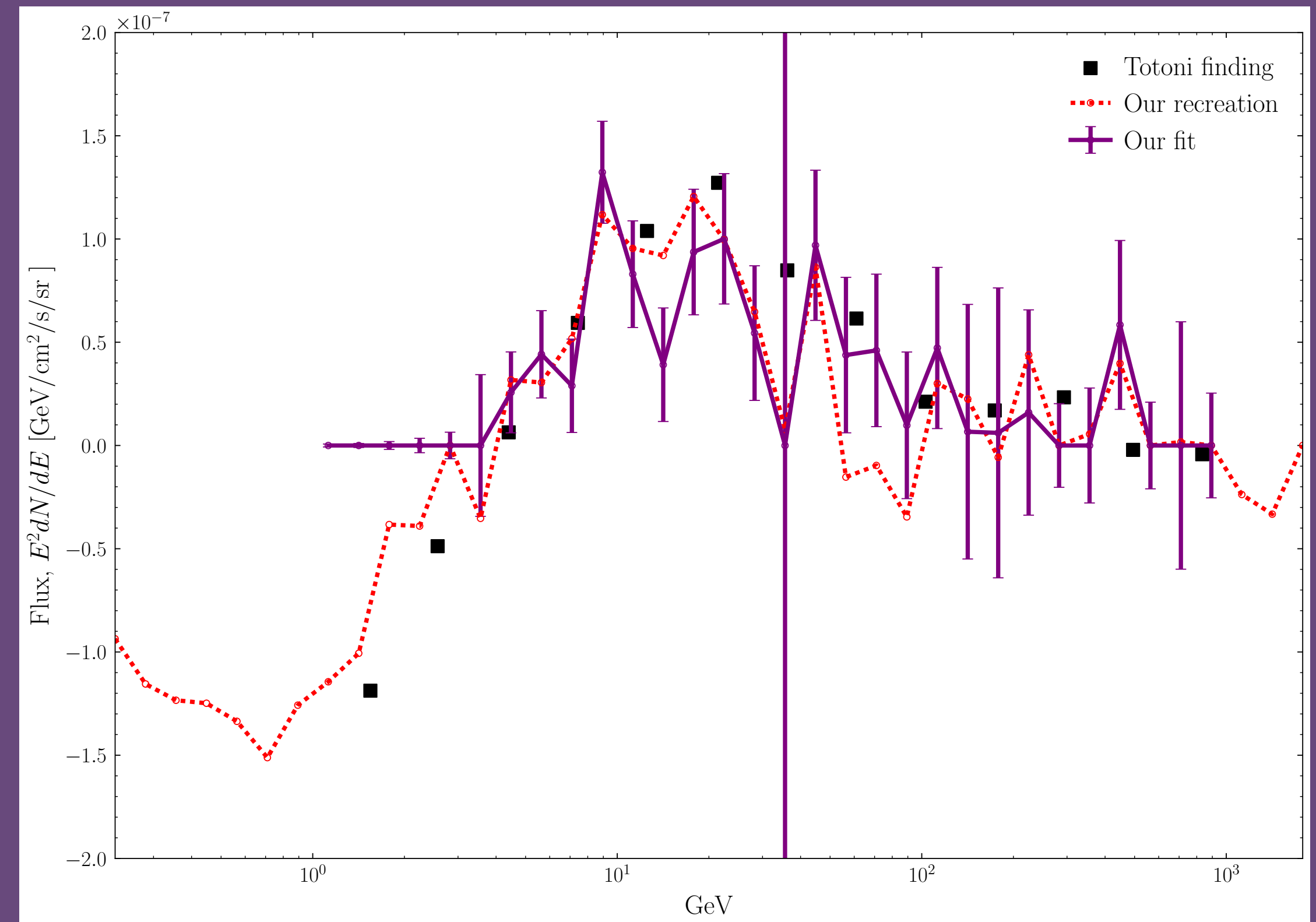


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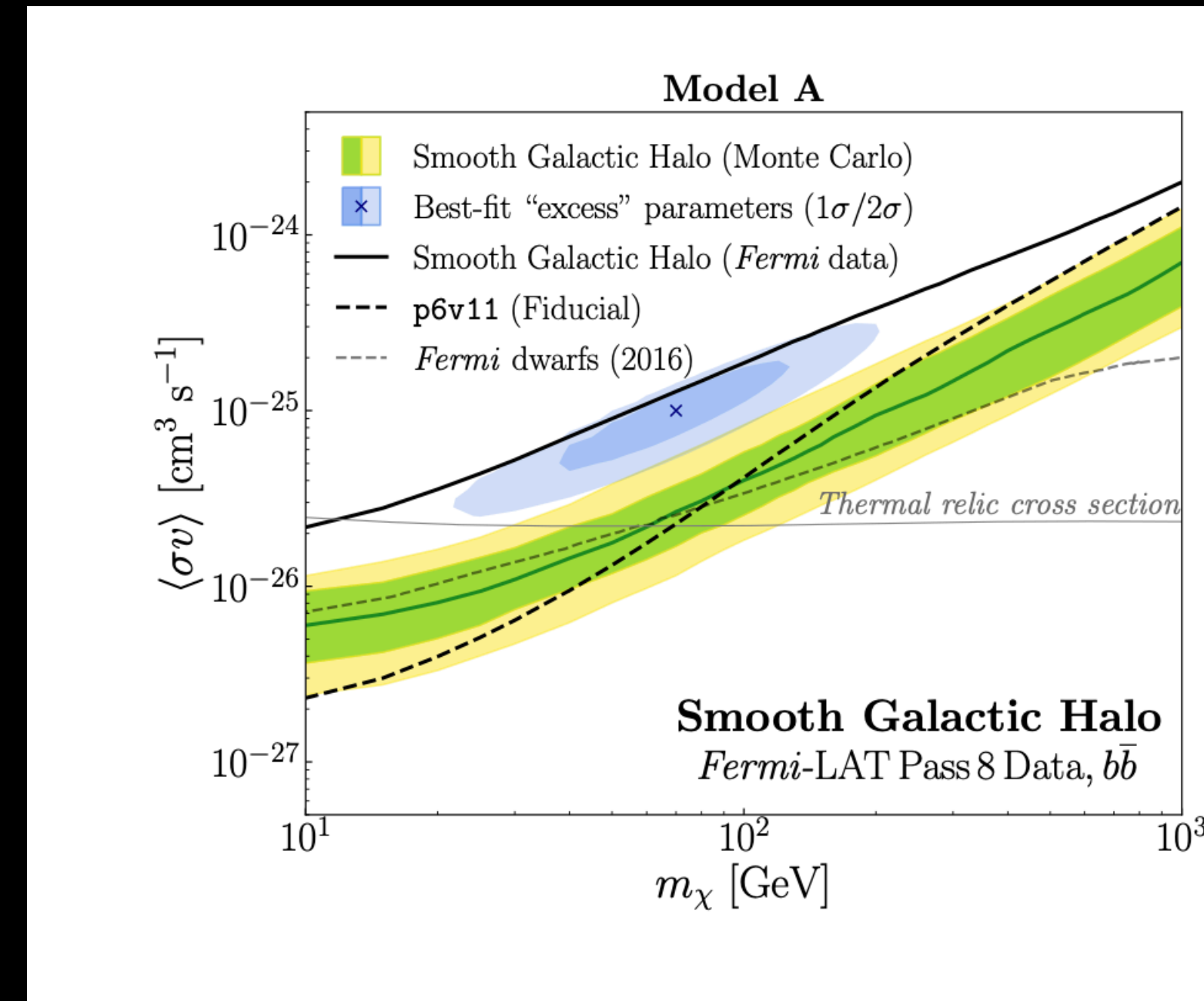
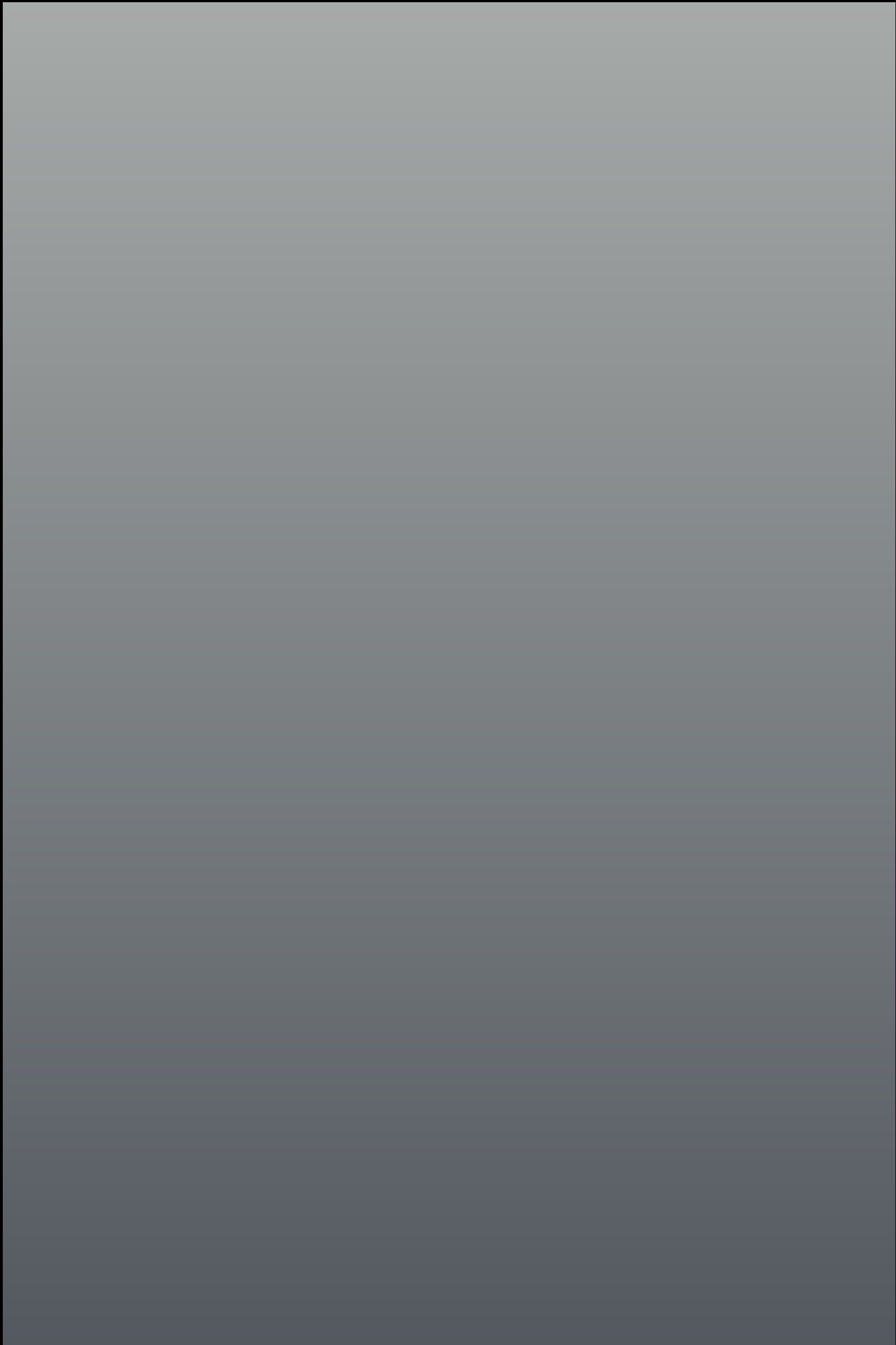
CONCLUSION

- * The 20 GeV excess exists
- * It is somewhat robust to GALPROP choices
- * NS asymmetry doesn't match a DM signal
- * More work is to be done!



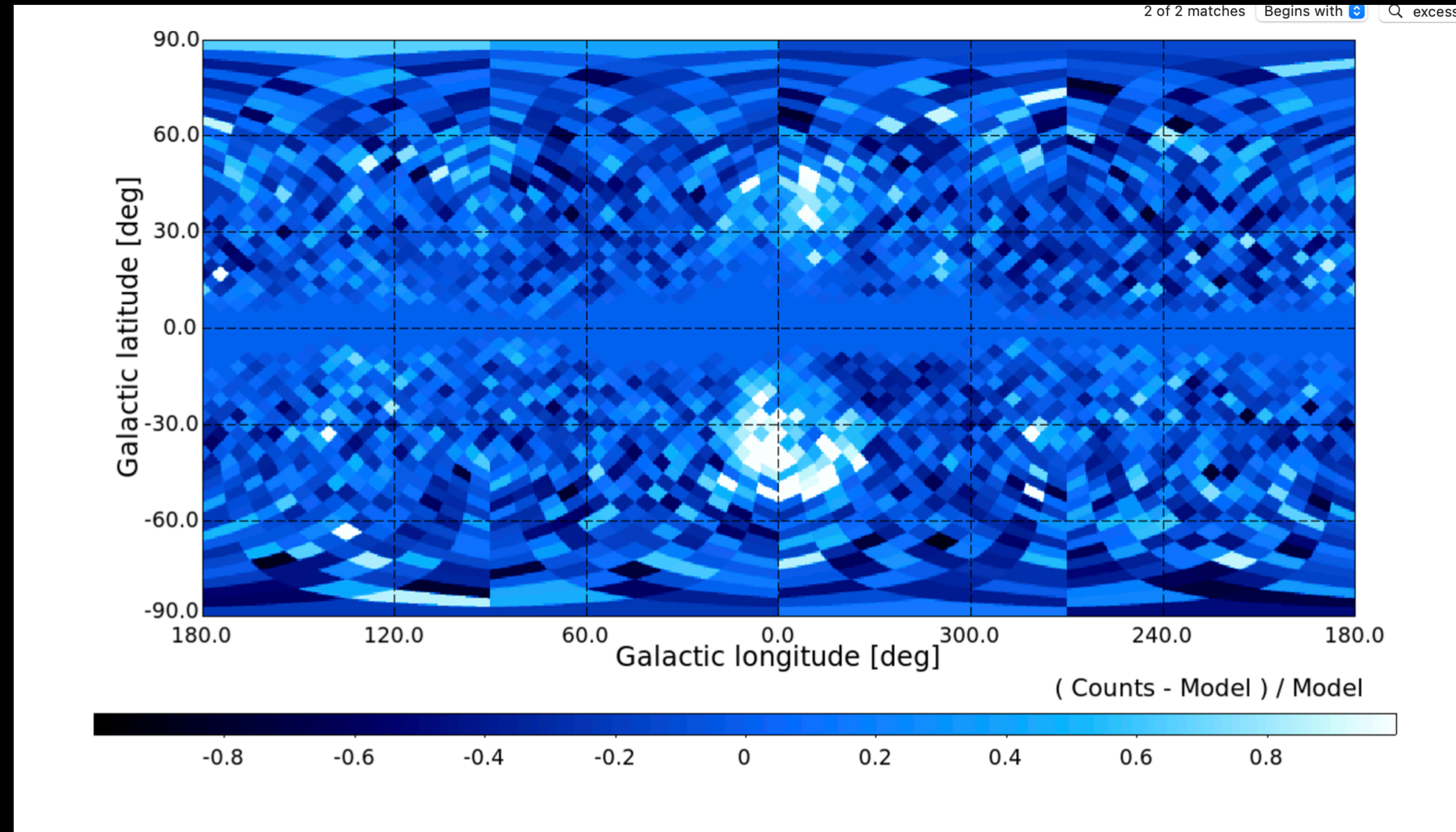
Bonus Slides

EARLIER SIGNS OF THE EXCESS



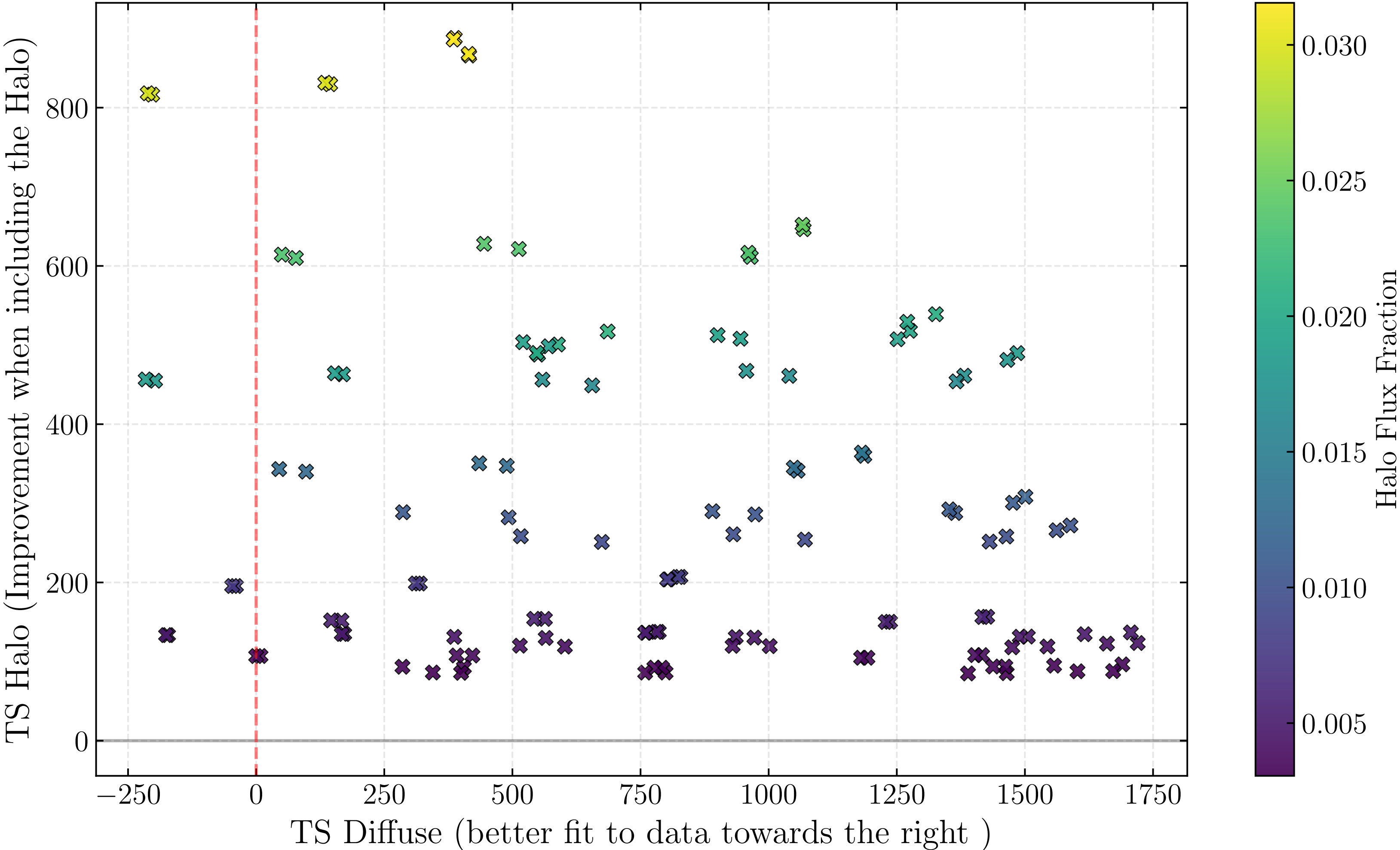
Chang, L, Lisanti, M, and Mishra-Sharma, S. "A Search for Dark Matter Annihilation in the Milky Way Halo." Dec 2018. arXiv:1804.04132.

EARLIER SIGNS OF THE EXCESS ? CONT.

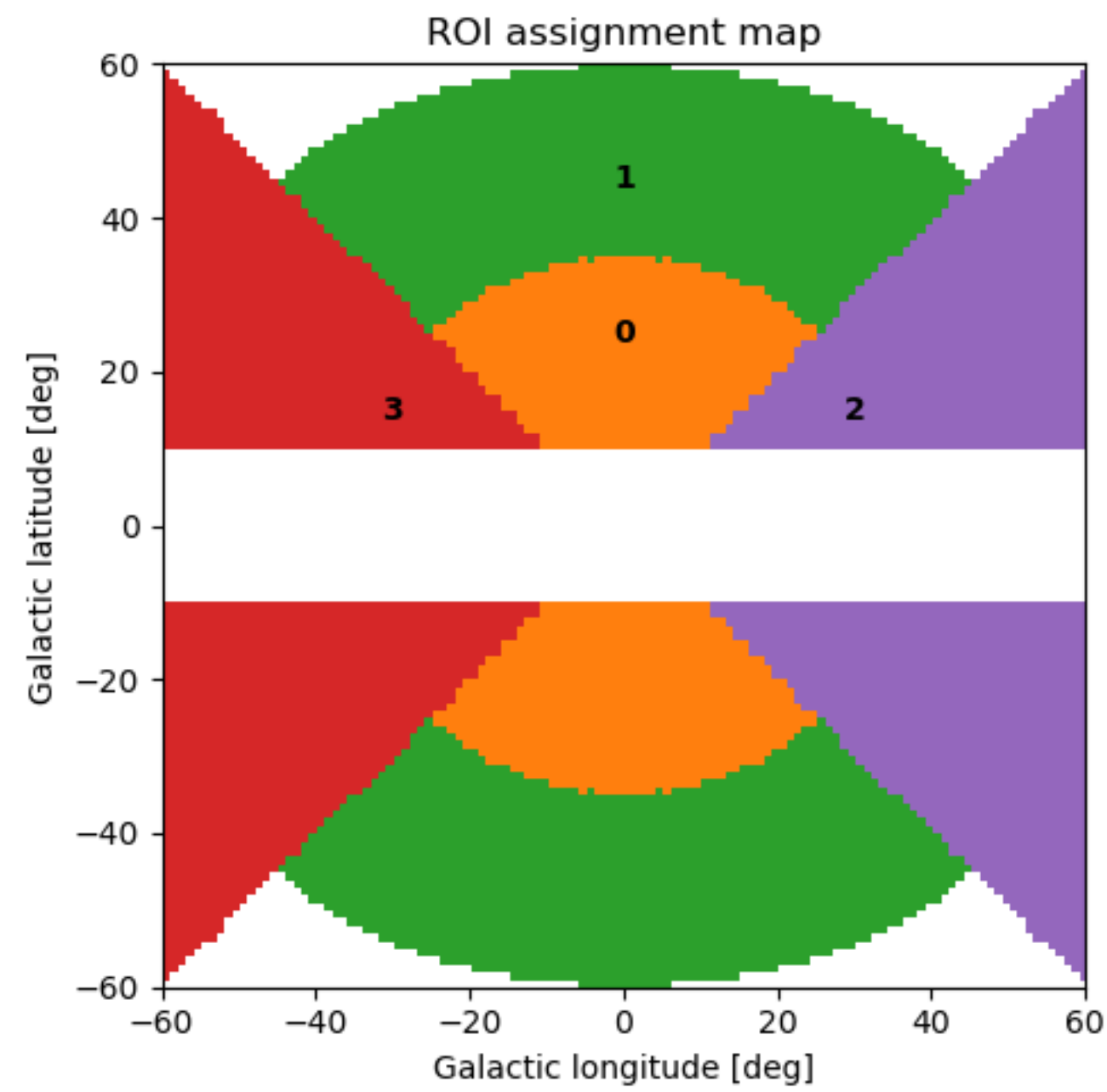


Fermi Collaboration. "The spectrum of isotropic diffuse gamma-ray emission between 100 MeV and 820 GeV." Oct 2014. arXiv:1410.3696.

FLUX IN NFW BY DIFFUSE GOODNESS OF FIT



SIGNAL SCALING ACROSS ROIS



Inspired by Calore, Cholis, Weniger.
1409.0042

