ICRC2019
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THE ASTROPARTICLE PHYSICS CONFERENCE

Université Paris Diderot - APC Laboratory - Theory Group

High energy neutrino from the interaction in the Local Bubble

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ICRC 2019

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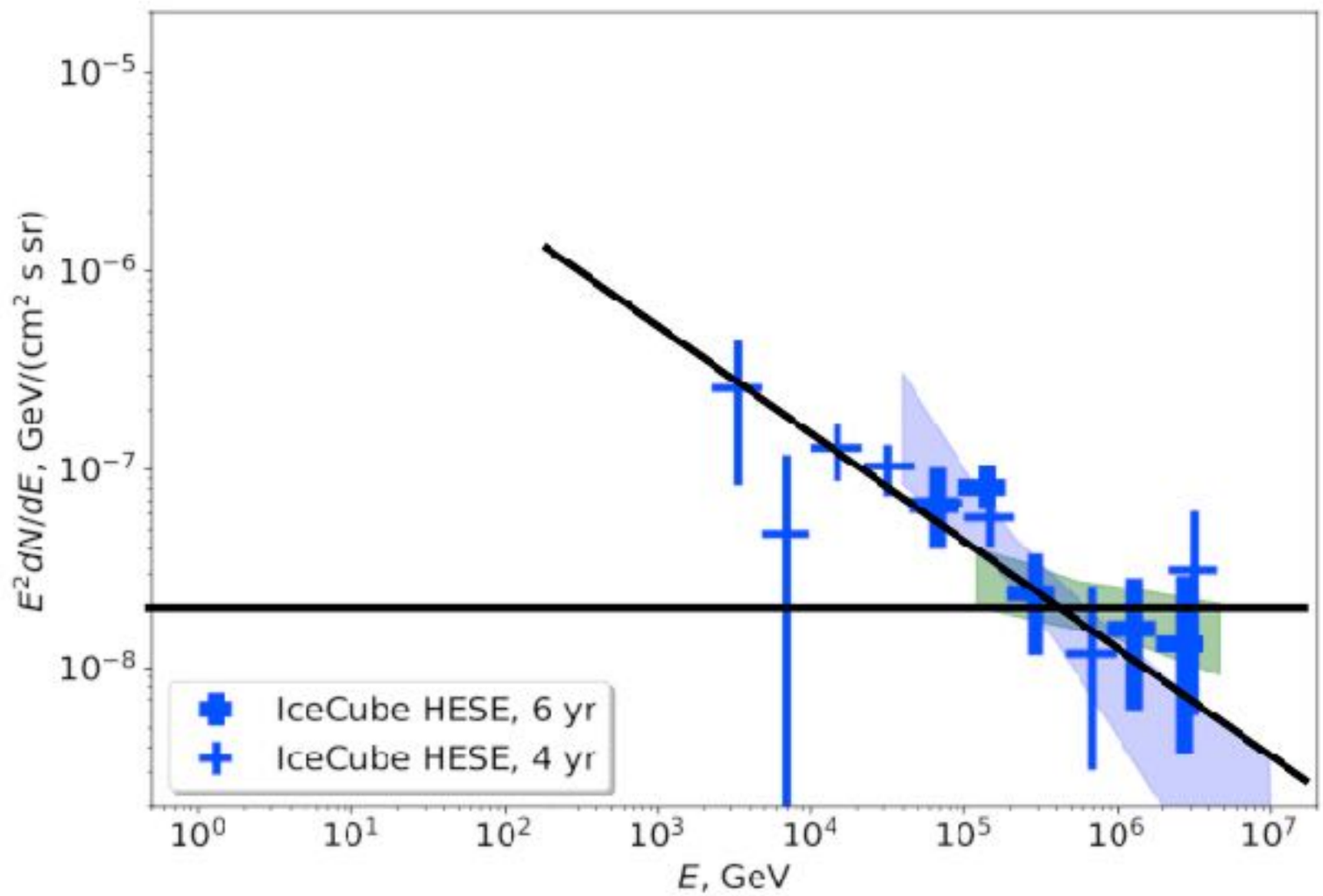
Introduction (Motivation)

- Decay of Dark Matter particles (V.S Berezinsky - P. Gondolo, G. Gelmini, S.Sarkar)

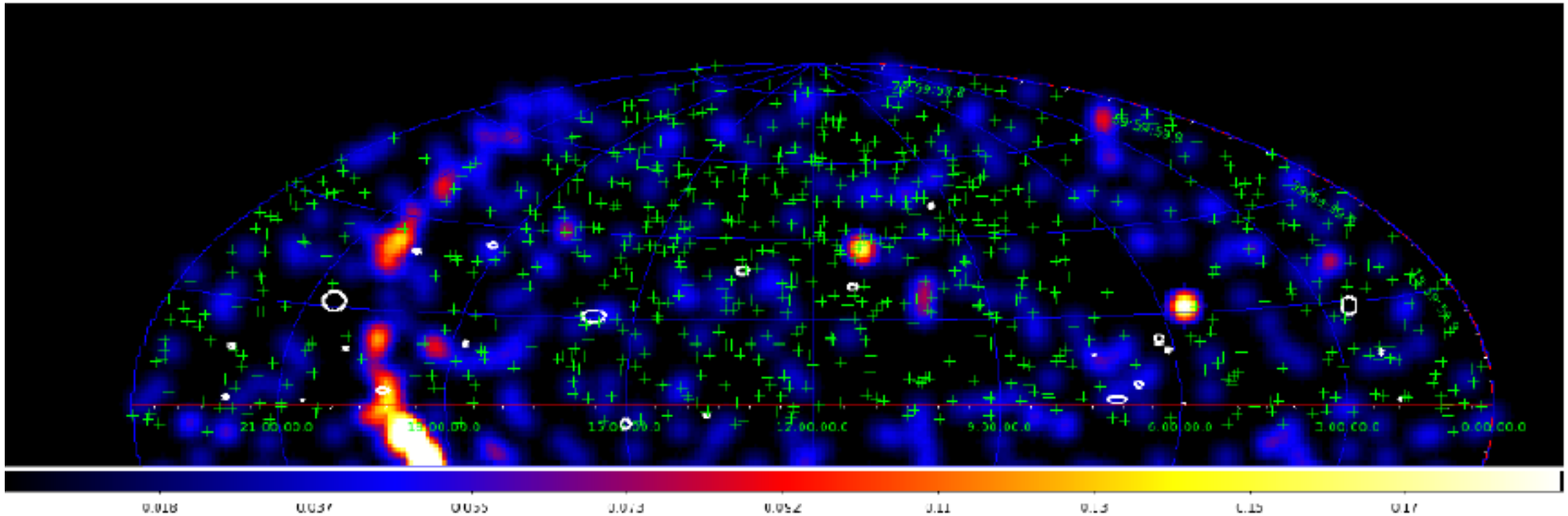
- **Interaction of cosmic rays**



Introduction (Motivation)

cm $^{-}$ s $^{-}$). We employ a one-point photon fluctuation analysis to constrain the behavior of dN/dS below the source detection threshold. Overall the source count distribution is constrained over three decades in flux and found compatible with a broken power law with a break flux, S_b, in the range $[8 \times 10^{-12}, 1.5 \times 10^{-11}]$ ph cm^{-2} s^{-1} and power-law indices below and above the break of $\alpha_2 \in [1.60, 1.75]$ and $\alpha_1 = 2.49 \pm 0.12$ respectively. Integration of dN/dS shows that point sources account for at least $86^{+16}_{-14}\%$ of the total extragalactic γ-ray background. The simple form of the derived source count distribution is consistent with a single population (i.e. blazars) dominating the source counts to the minimum flux explored by this analysis. We estimate the density of sources

Fermi collaboration, arXiv:1511.00693



A.Neronov, D.Semikoz, K.Ptitsyna arXiv 1611.06338v2

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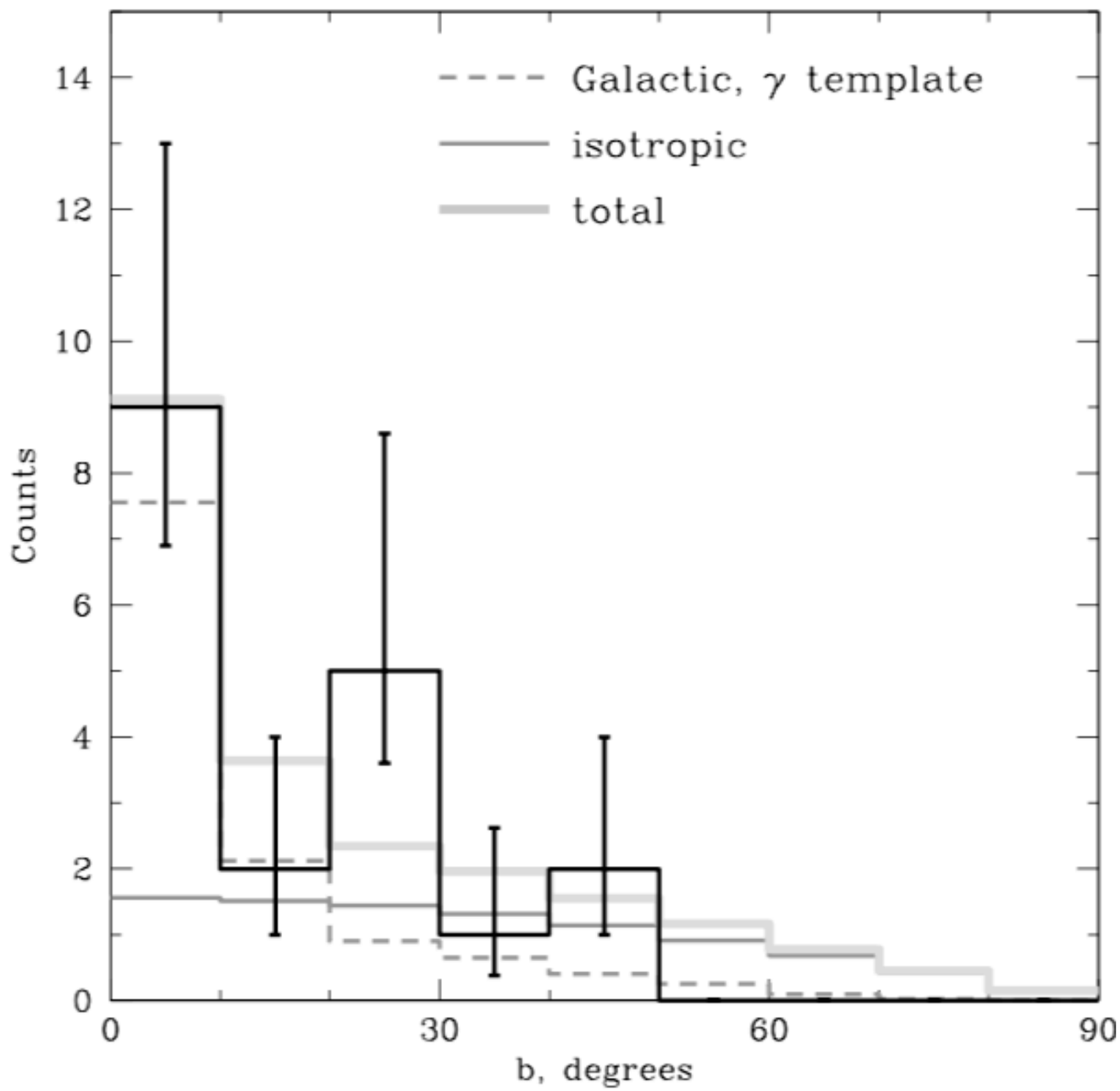

A.Neronov, D.Semikoz,
arXiv 1509.03522v2

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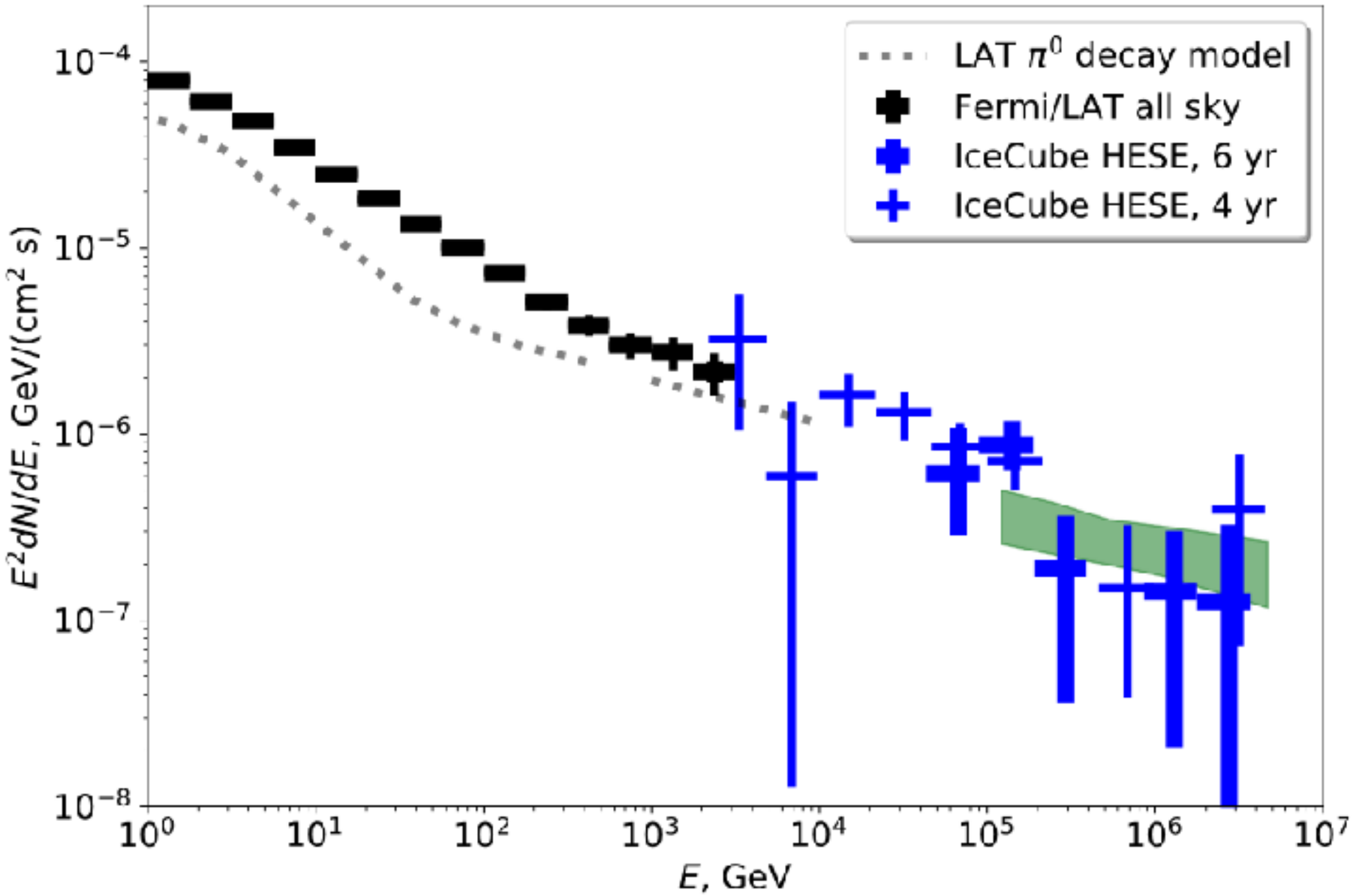

A.Neronov, M.Kacherlriess D.Semikoz arXiv 1802.09983v3

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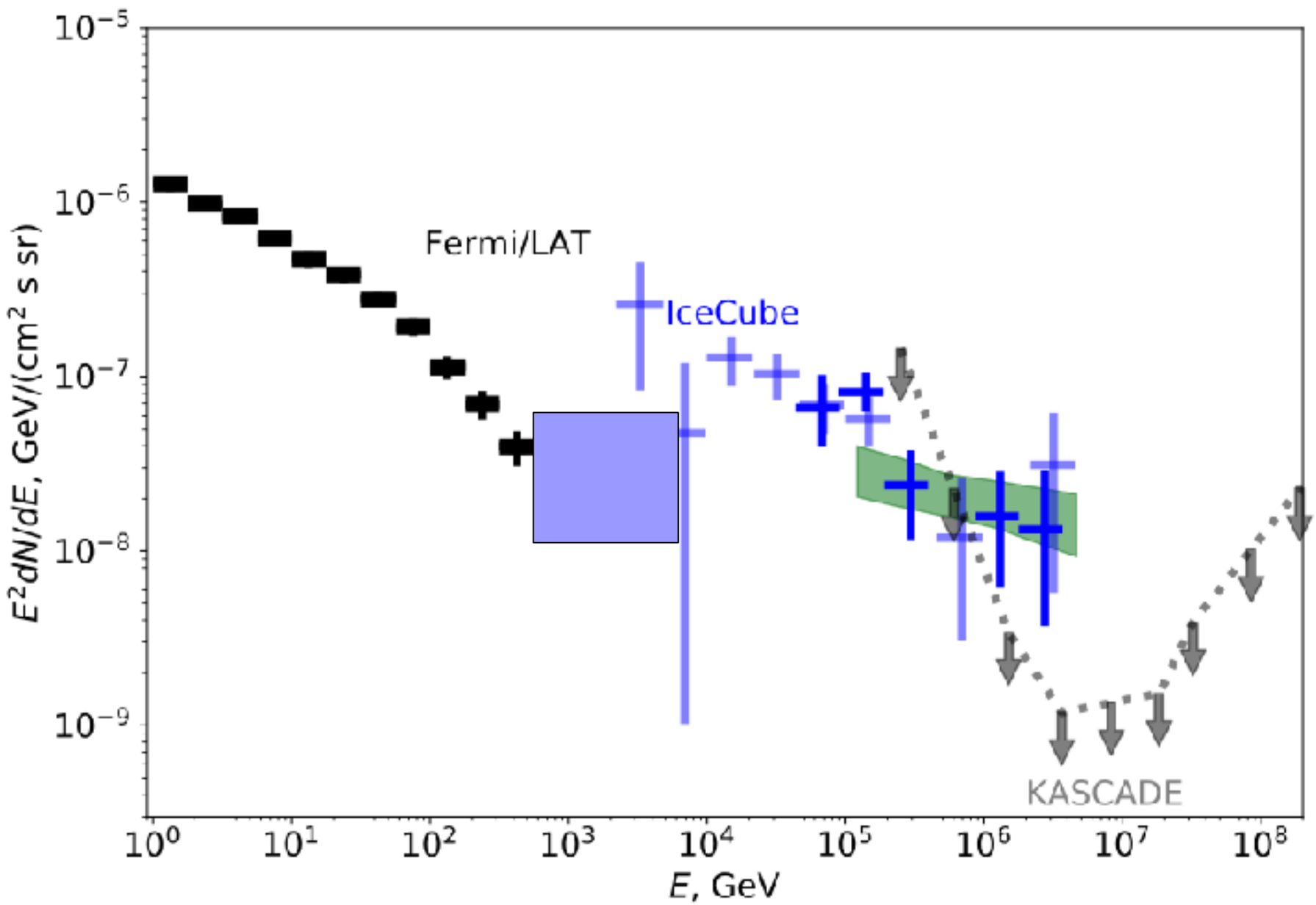

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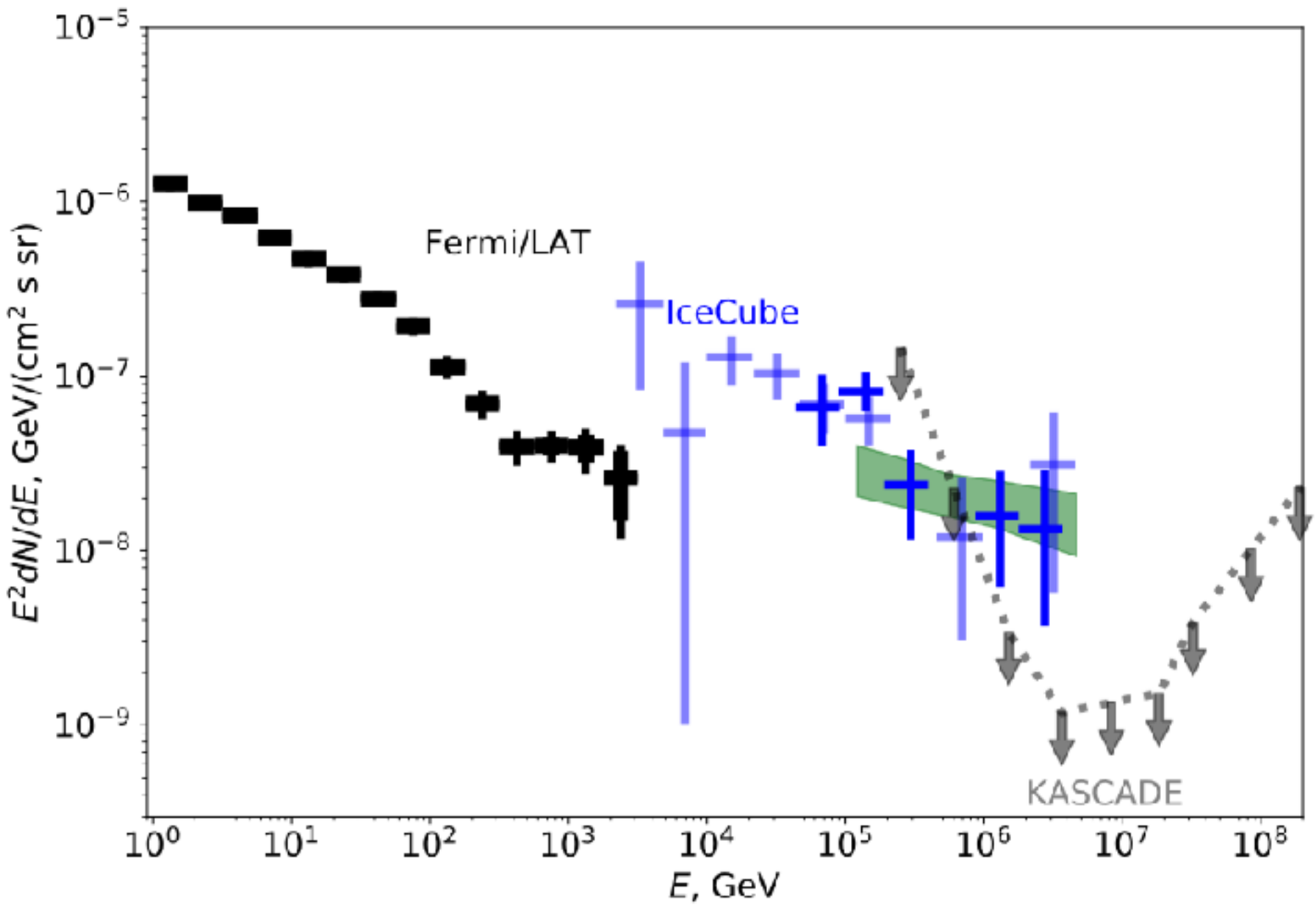

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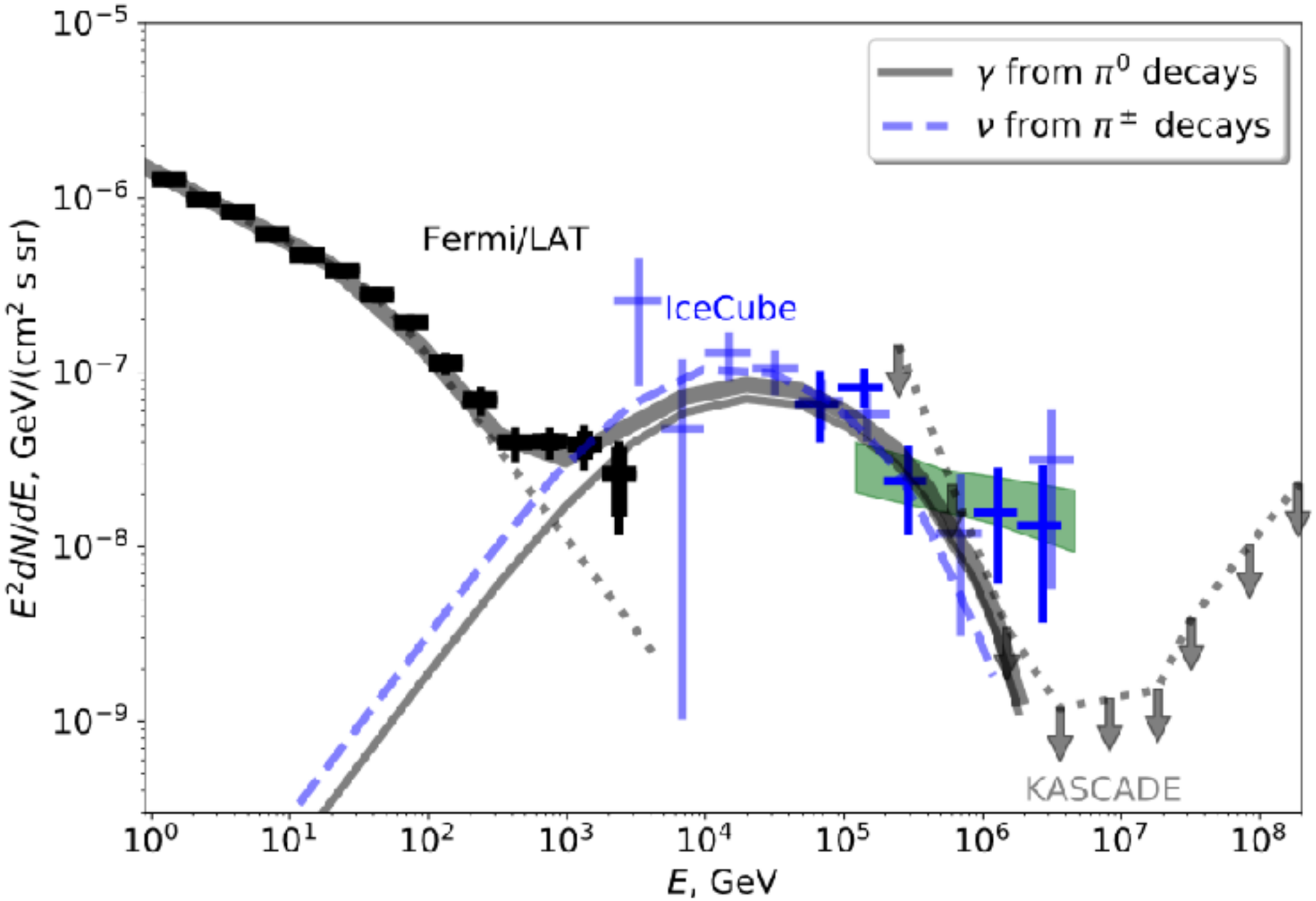
Introduction (Explanations)



A.Neronov, M.Kacherlriess D.Semikoz arXiv 1802.09983v3

Introduction (Explanations)

- Cosmic ray interaction in the large halo of MW
- **Interaction of cosmic rays injected by a young nearby supernova**

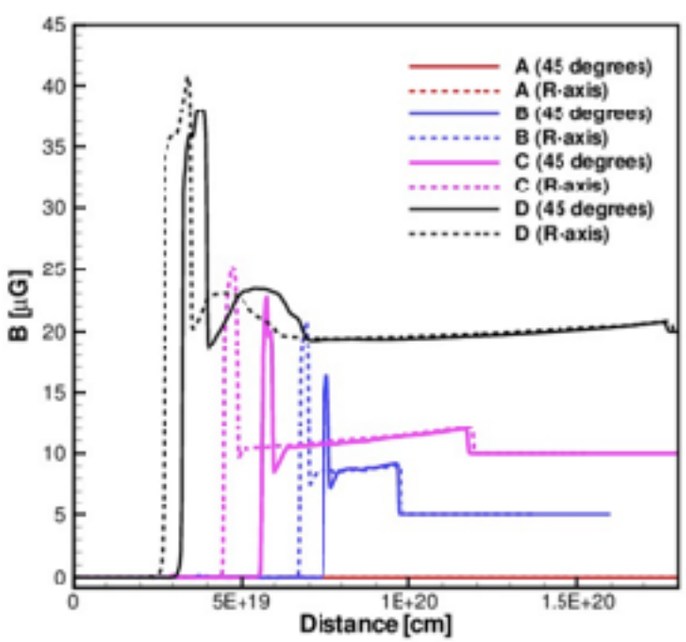
Model (Construction)

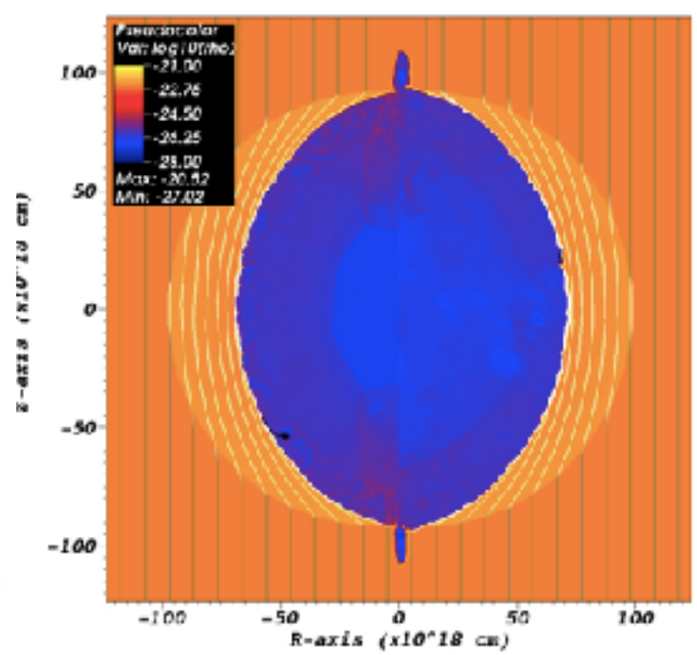
- Injection of cosmic rays from the source :

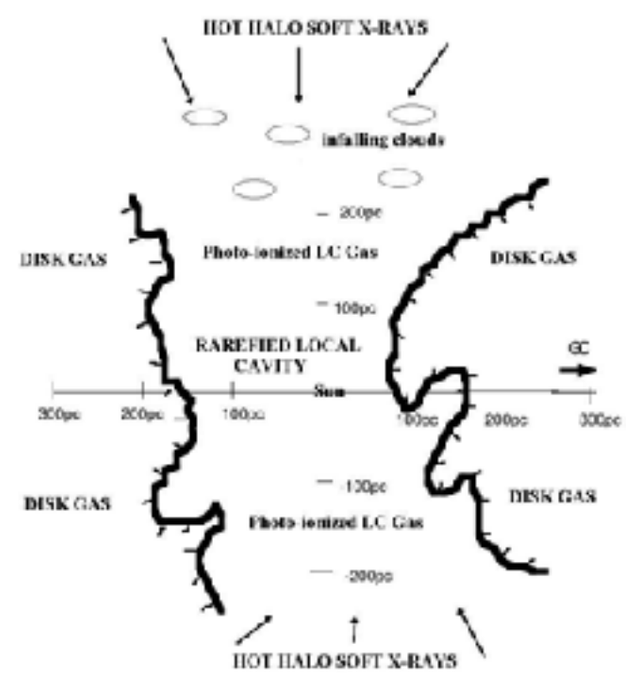
$$\frac{dN}{dE} \propto \begin{cases} E^{\beta_1}, & \text{if} \quad E < ZE_{\text{br}} \\ E^{\beta_2} \exp(-E/(ZE_{\text{max}})), & \text{if} \quad E \geq ZE_{\text{br}}. \end{cases}$$

L. O. Drury, E. van der Swaluw and O. Carroll (2003) astro-ph/0309820

- Magnetic field modélisation of the bubble :

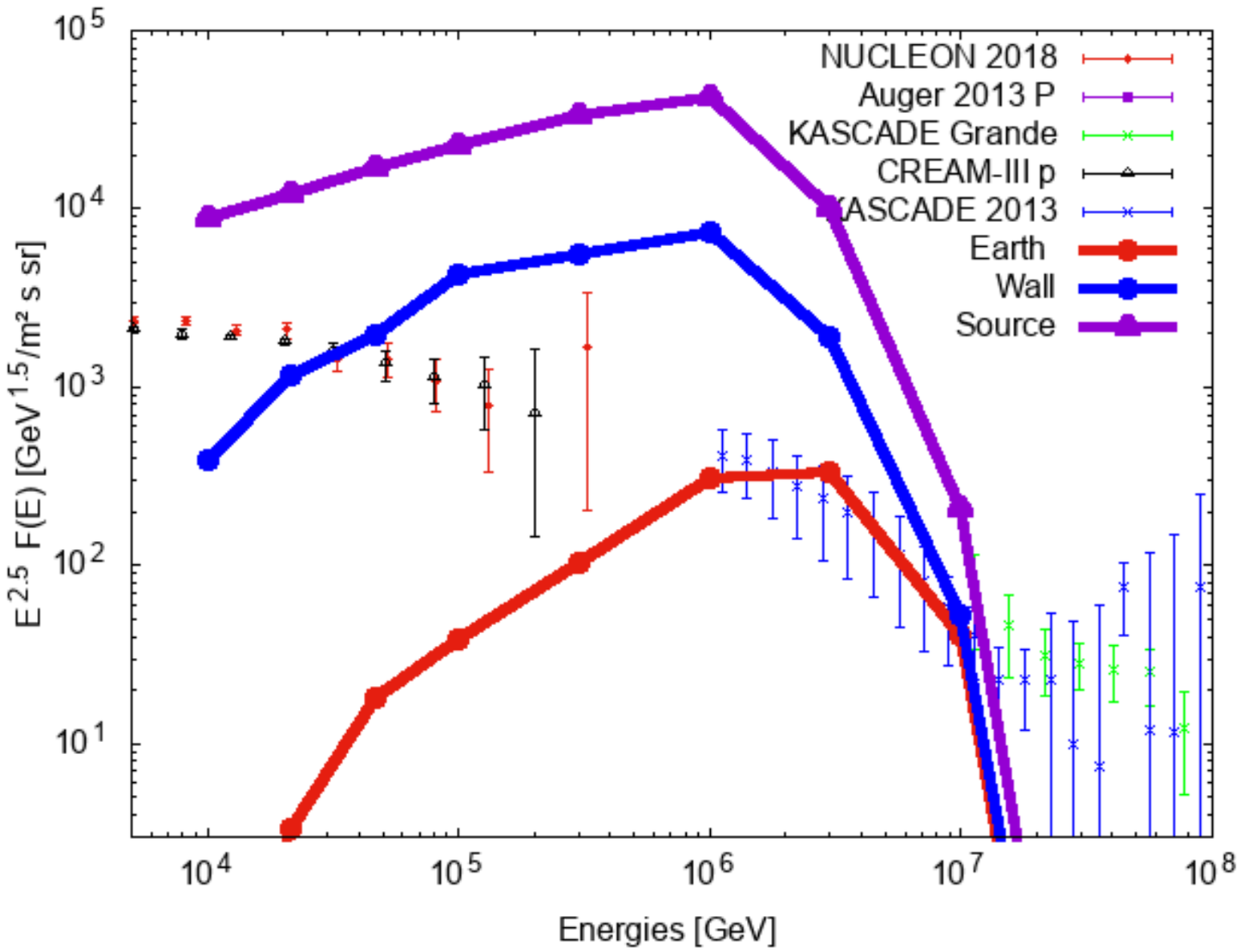






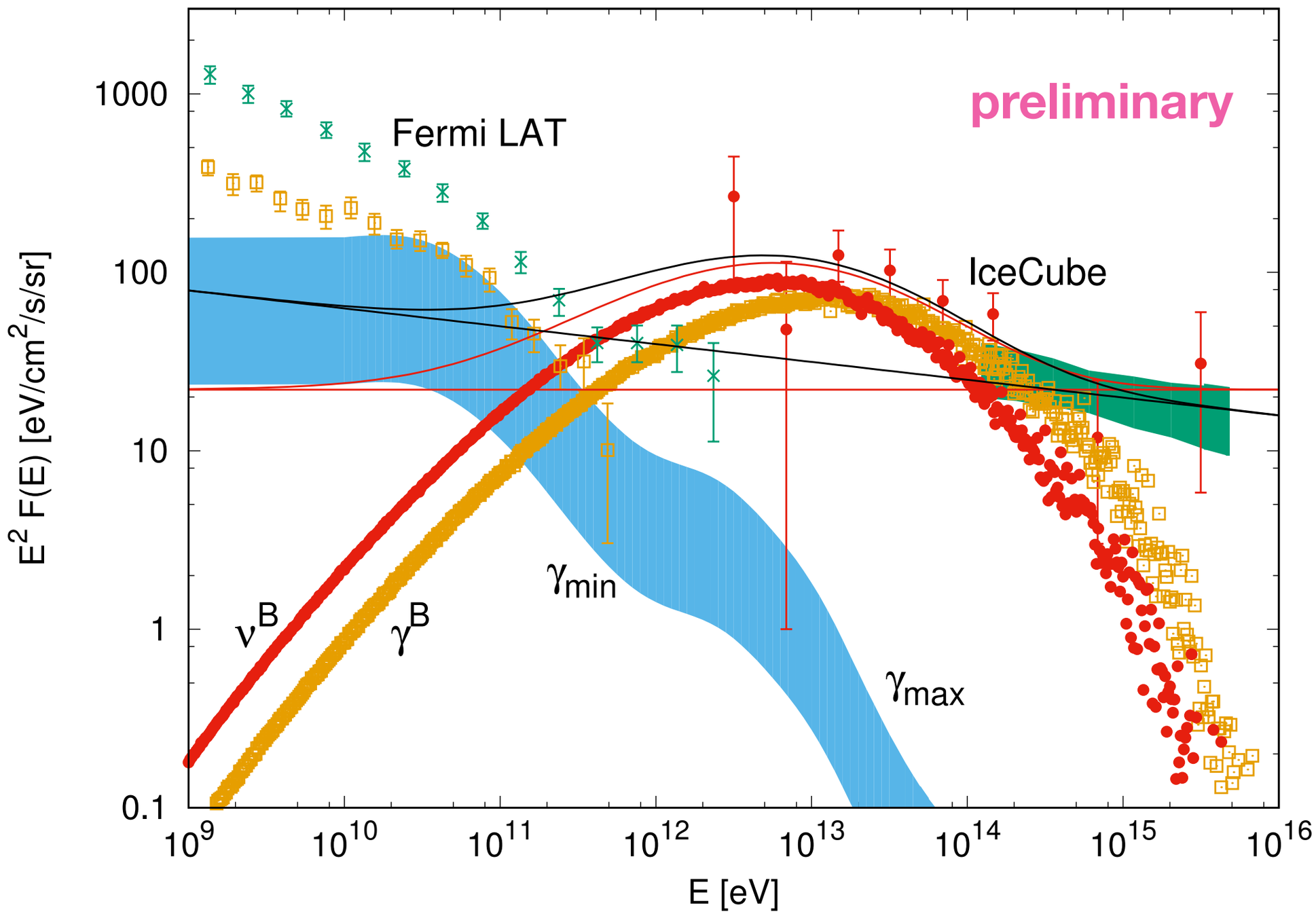
Welsh & Shelton 2009 arXiv 0906.2827

Results (Proton flux on earth wall and source)



M.Kachelriess, D.Semikoz, B.M 2018 arXiv 1812.03522

Results (neutrinos and gamma rays)



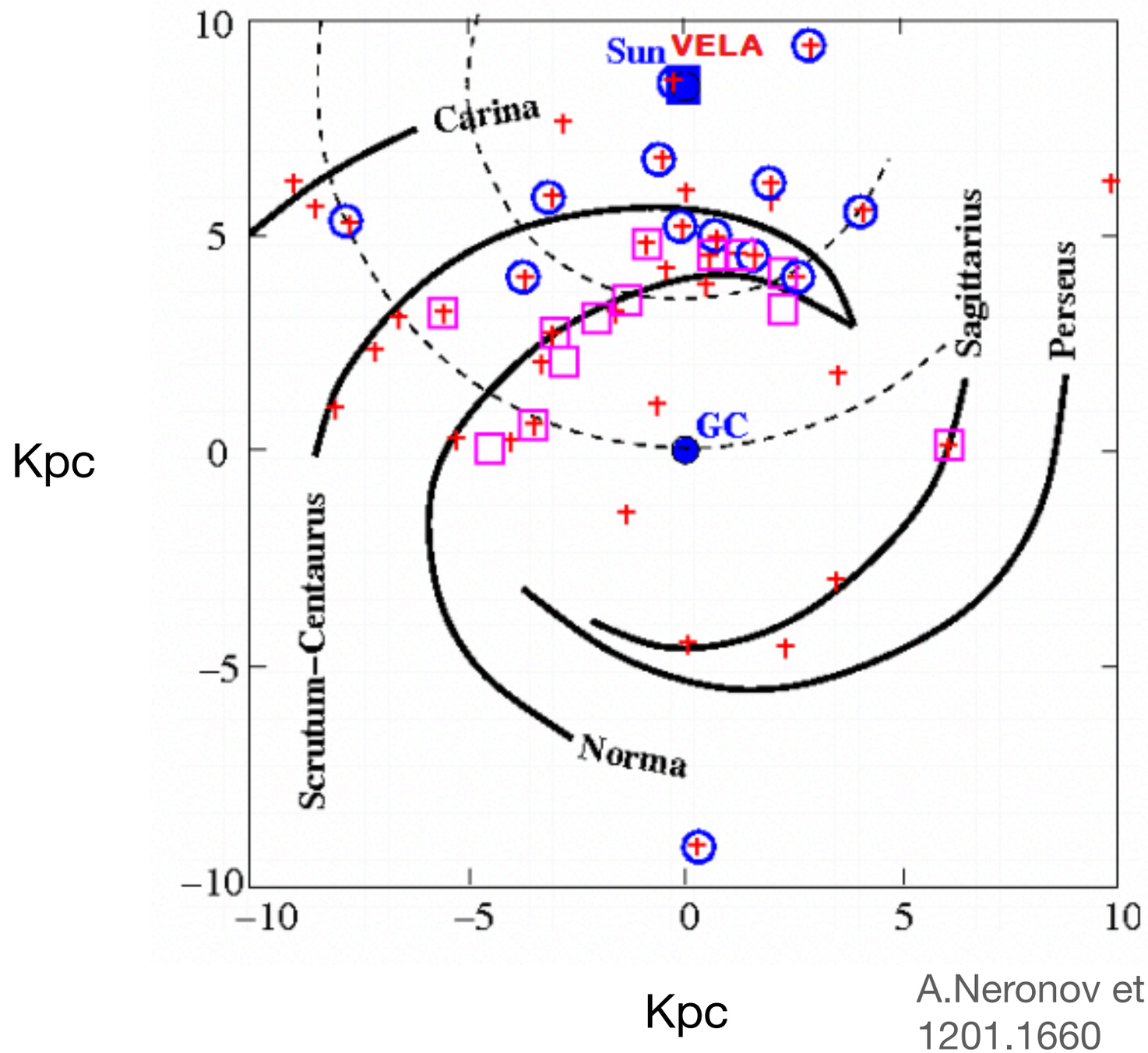
Summary

- Excess of gamma ray flux for E > 1 TeV outside the galactic plane
- Neutrino flux at E < 100 TeV should be galactic
- Multi-messenger signal from a young nearby SNR.
- Neutrino and Gamma ray flux could be explained by the interaction of Vela CR with the Local Bubble.

Thank you

BACK UP

Model of dominant source (Vela SNR)



A.Neronov et D.V.Semikoz. 2012. arXiv 1201.1660

BACK UP

Model (Construction)

Injection of cosmic rays from the source :

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Flux computation :

$$F(E) = c/(4\pi)n(E)$$

Source acceleration :

E_{br} β_1

E_{max} β_2

Magnetic field configuration :

w w_1

$B(r,z)_{in,sh,out}$ w_2