Diffuse Neutrinos From γ-ray Blazars via UHECR Propagation

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Luminosity dependent density evolution

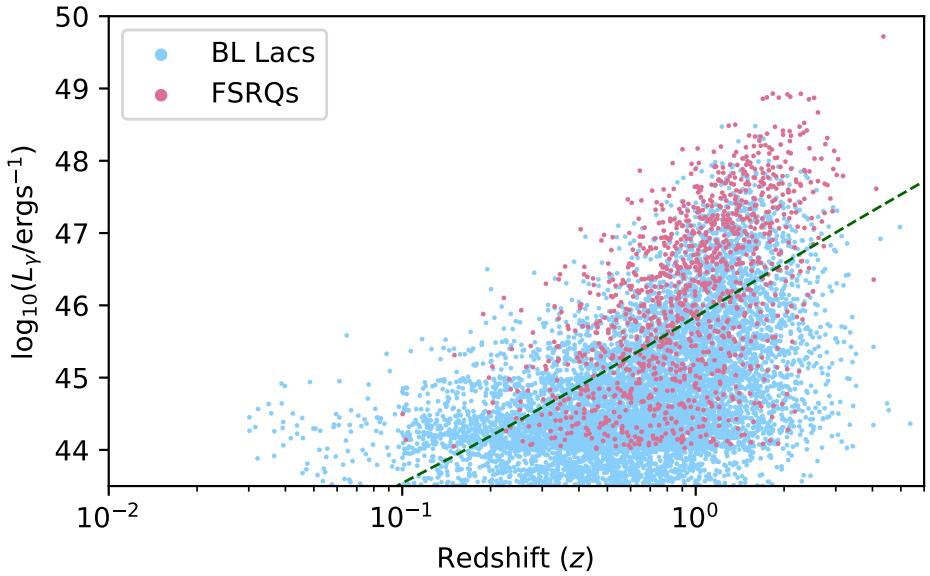

Figure: The distribution of blazars in luminosity-redshift space according to the luminosity function deduced in Ajello et al. (2012, 2013). Image: S. Das, N. Gupta, S. Razzaque; Astrophys. J. (submitted)

1. $\phi_\gamma = 1.25 \times 10^{-12}$ erg cm^{-2} s^{-1} line divides resolved and unresolved blazars
2. Highest luminosities are dominated by FSRQs – 742 resolved & 427 unresolved
3. Low luminosities are dominated by BL Lacs – 2072 resolved & 5931 unresolved
4. The effective baryon loading of the blazars $L_p = \eta_{\rm eff} L_{100}$, where $\eta_{\rm eff} \approx \eta/\Gamma_e^2$

Neutrino and IGRB fluxes

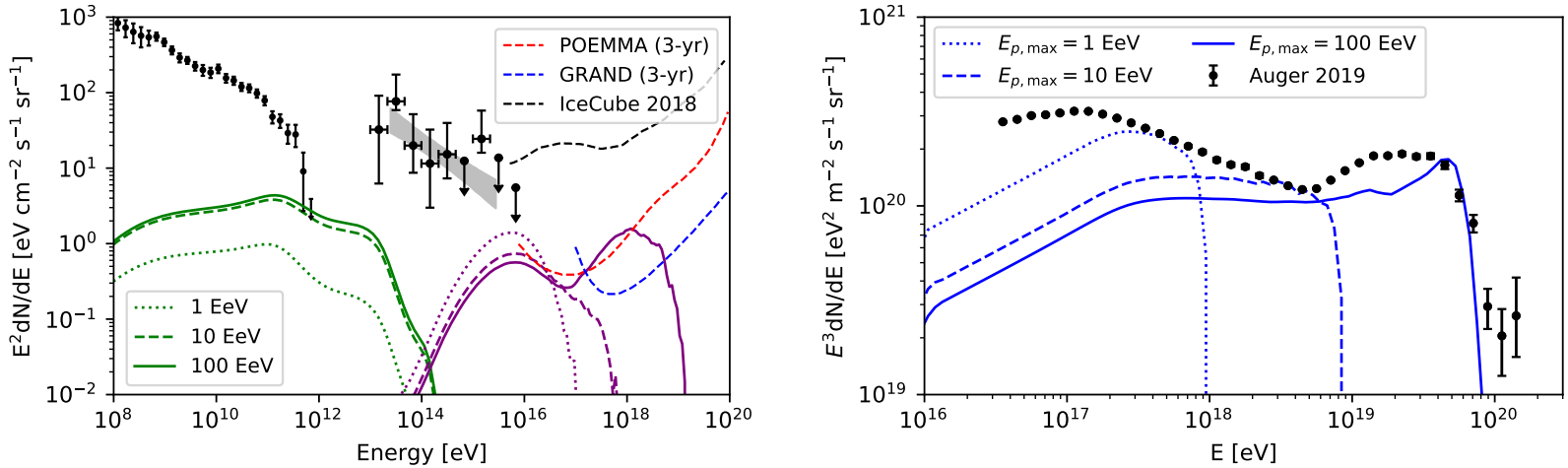

Figure: The secondary neutrino and gamma-ray fluxes for $E_{p,\max} = 1$, 10, and 100 EeV. Image: S. Das, N. Gupta, S. Razzaque; Astrophys. J. (submitted)

1. Injected proton spectrum: $dN/dE \propto E^{-2.6}$. $E_{p,\max}$=1, 10, 100 EeV.
2. Escape dominates over $p\gamma$ inside jet at $E > 10^{15}$ eV. Flux $\propto$ baryon loading
3. Neutrino flux is $\gtrsim$ 10% of the IceCube prediction at 6 PeV
4. Maximum baryon load for minimum $E_{p,\max}$ – constrained by cosmic ray data

Summary

1. We assume the γ-ray flux in the 100 MeV - 100 GeV band observed by Fermi-LAT originates entirely in leptonic processes inside the source

2. We assume cosmic rays efficiently escape the system beyond 10 PeV – valid as long as $t_{\rm esc}^{-1} > t_{\rm p\gamma}^{-1}$ – sub-PeV neutrinos are produced inside the sources.

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3. In this scenario, more luminous sources contribute more to neutrino & IGRB backgrounds, since, $L_p \propto L_\gamma$ – may not hold invariably for all sources.

4. The baryon load is constrained by the UHECR flux, for a given $E_{p,\rm max}$ – the latter being constrained by the IGRB background.