

Neutrino constraints to gamma-ray emission from accretion shocks

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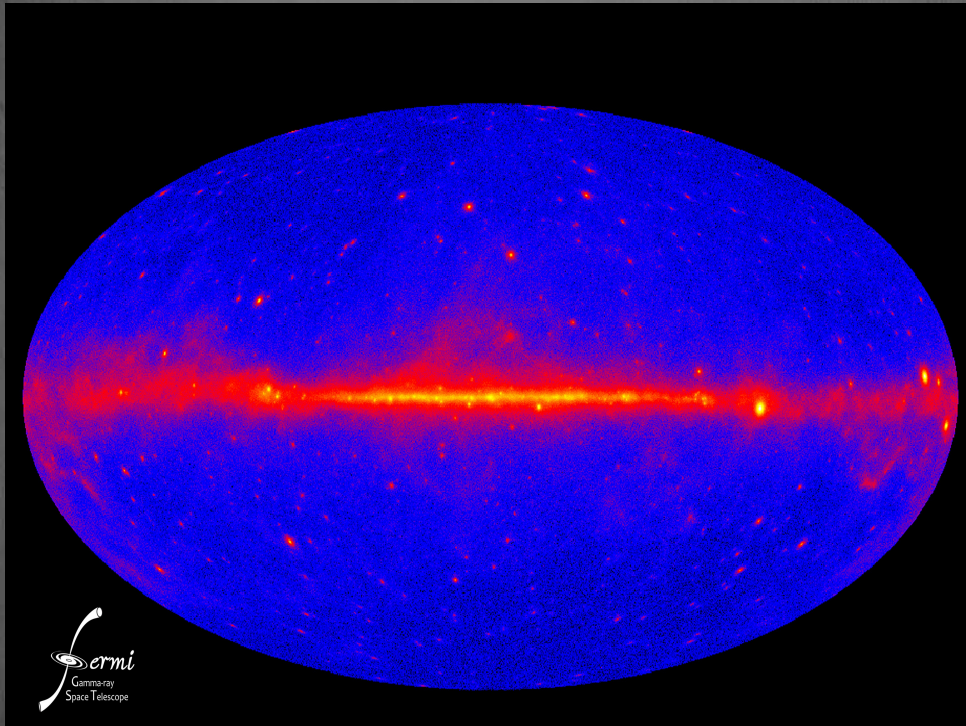
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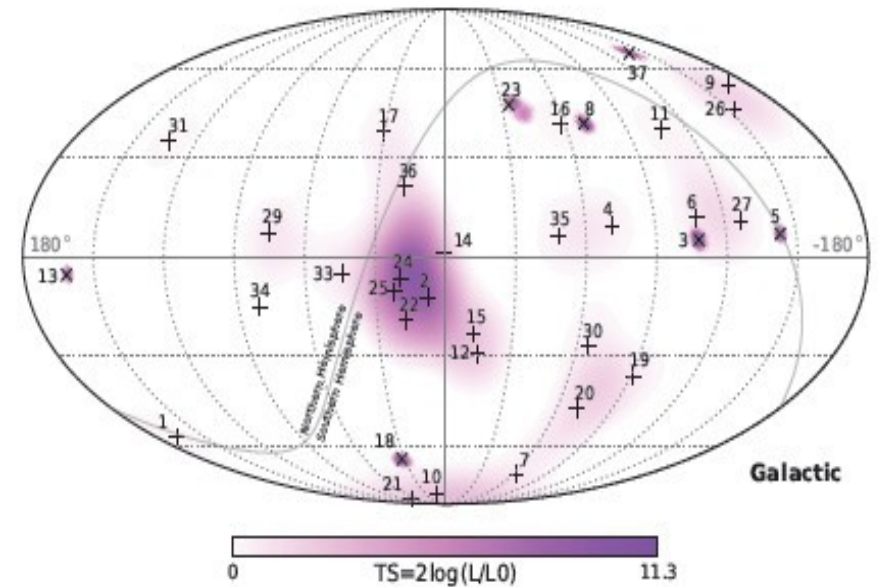
Gamma rays



Fermi-LAT
0.1-820 GeV

Ackermann et al. (2015)

Neutrinos

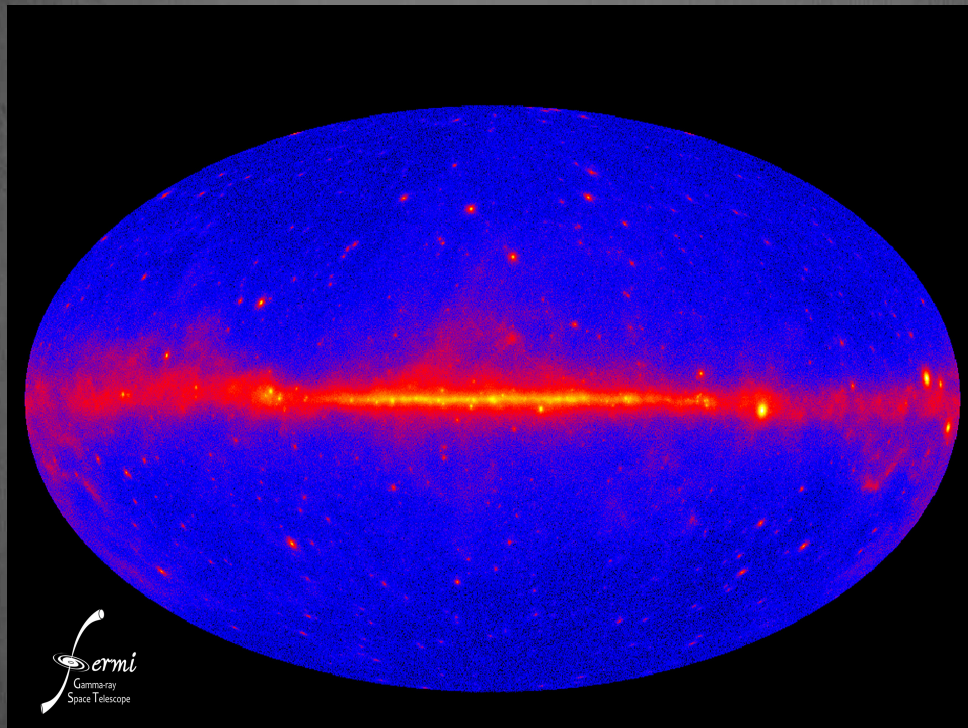


IceCube
0.06 TeV - 3 PeV

Aartsen et al. (2014, 2015)

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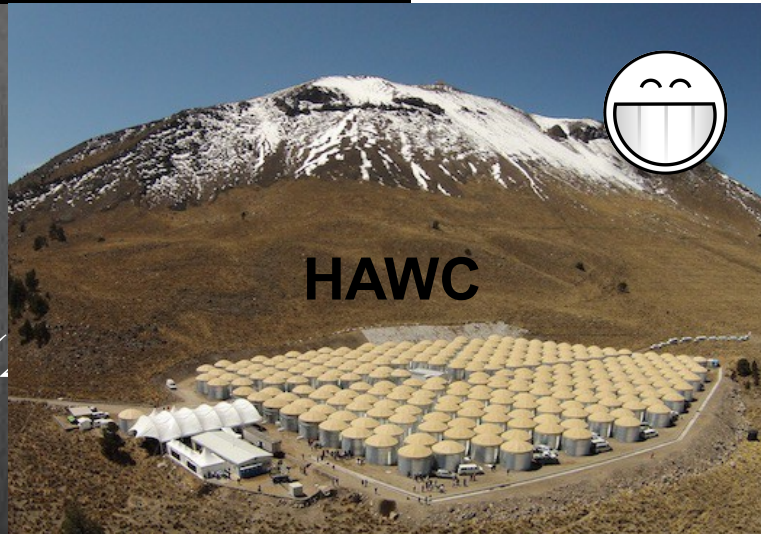
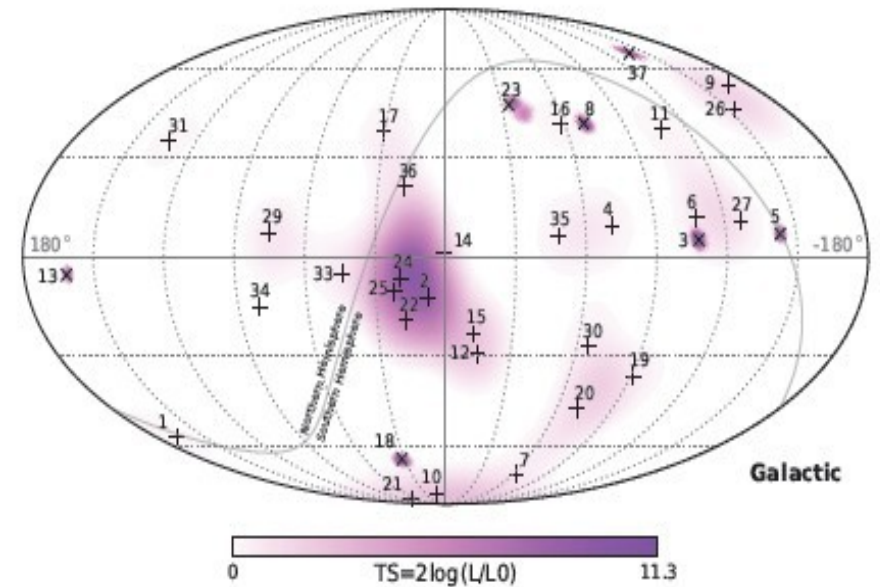
Gamma rays



Fermi-LAT
0.1-820 GeV

Ackermann et al. (2012)

Neutrinos



HAWC

0.1-3 PeV

et al. (2014, 2015)

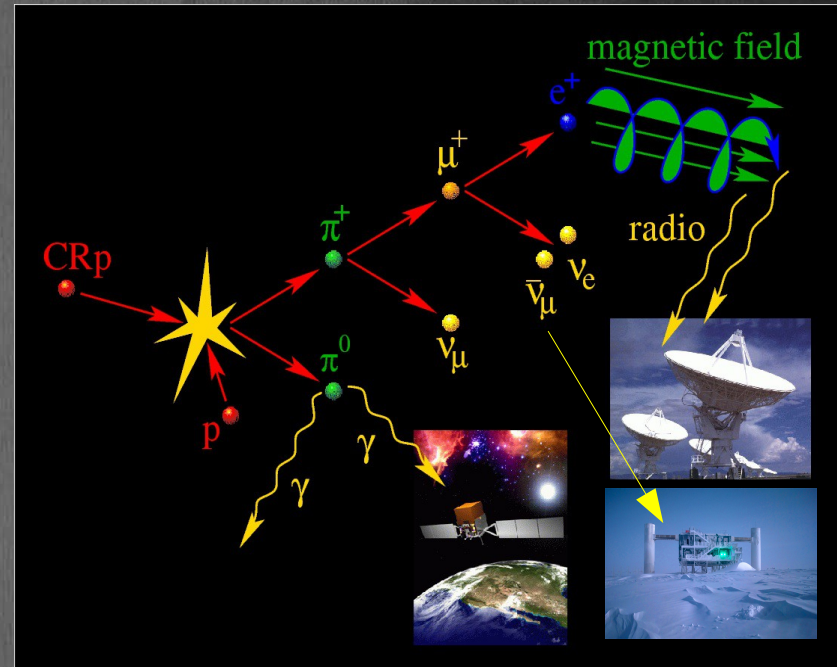
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- Hadronic origin, simple gamma-ray - neutrino link.

Ahlers & Murase (2014)

Chang & Wang (2014)

Tamborra et al. (2014)



- Ice Cube neutrinos - 54 events

Best fit spectrum:

$\alpha = -2.0$ 60 TeV - 3 PeV (*Aartsen et al. 2014*)

$\alpha = -2.46$ 25 TeV - 1.4 PeV (*Aartsen et al. 2015*)

$\alpha = -2.50$ 25 TeV - 2.8 PeV (*Aartsen et al. 2015*)

- Accretion shocks - large scale structures, galaxy clusters
- Proportional to cosmic accretion rate

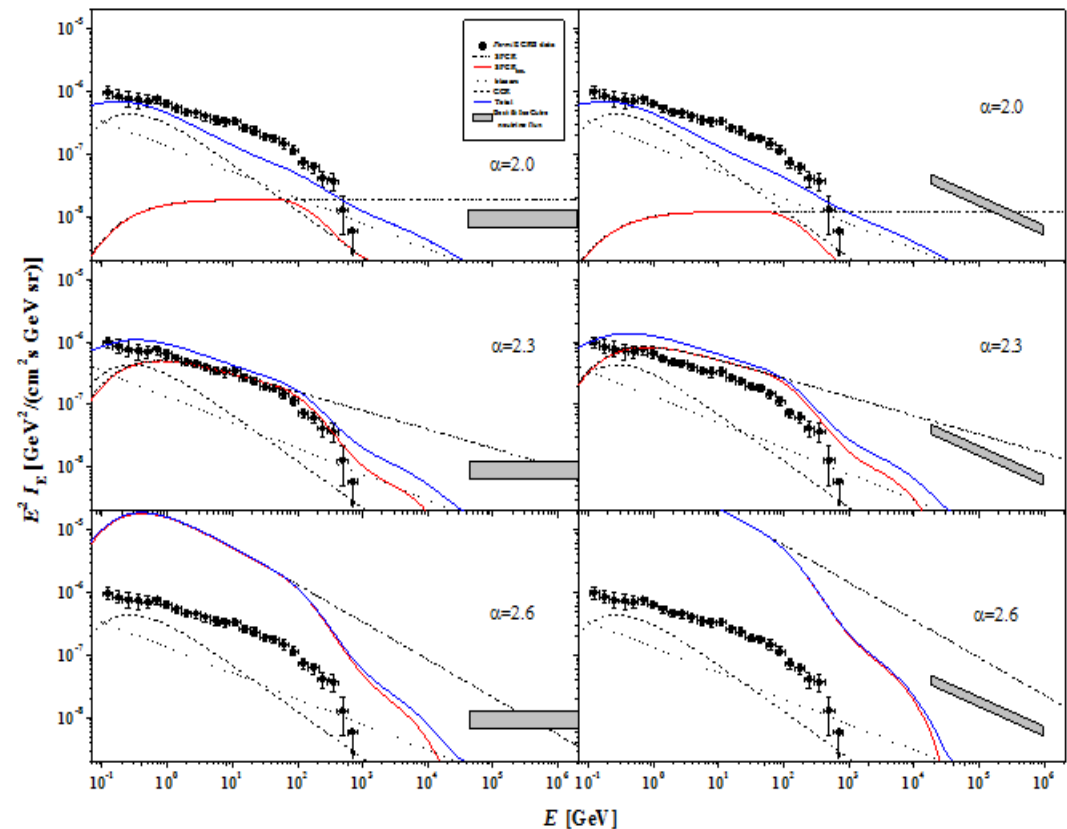
Pavlidou & Fields (2006)

Contribution of SFCRs
to EGRB by Fermi:

46% (18%)

29% (12%)

- Structure formation cosmic rays (SFCR) hypothetical unobserved



Dobardžić & Prodanović (2015)

Conclusion

- Accretion shocks around large scale structures can accelerate cosmic rays (SFCR), which should leave an imprint on the EGRB.

- Gamma-ray emission models of CRs from accretion shocks:

Dobardžić & Prodanović (2014) - normalised to Coma cluster

Dobardžić & Prodanović (2015) - normalised to IceCube neutrinos

- Strongest model-independent observational limit to this still unobserved cosmological CR population.

Thank you!

