Diffuse neutrinos from extragalactic supernova remnants: dominating the 100 TeV IceCube flux

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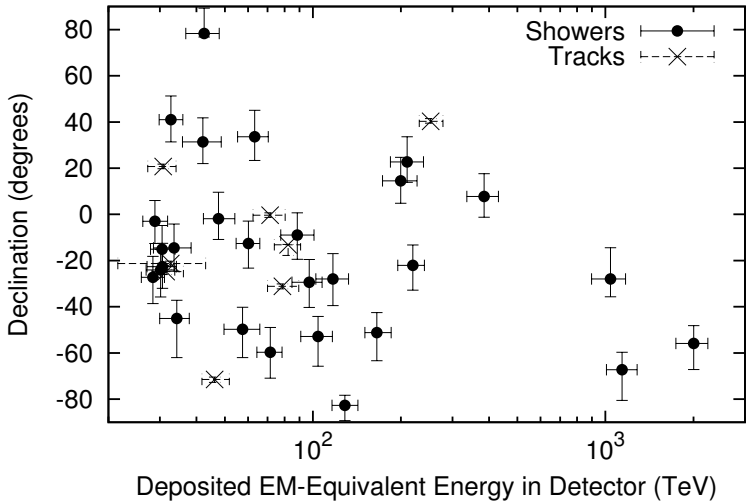
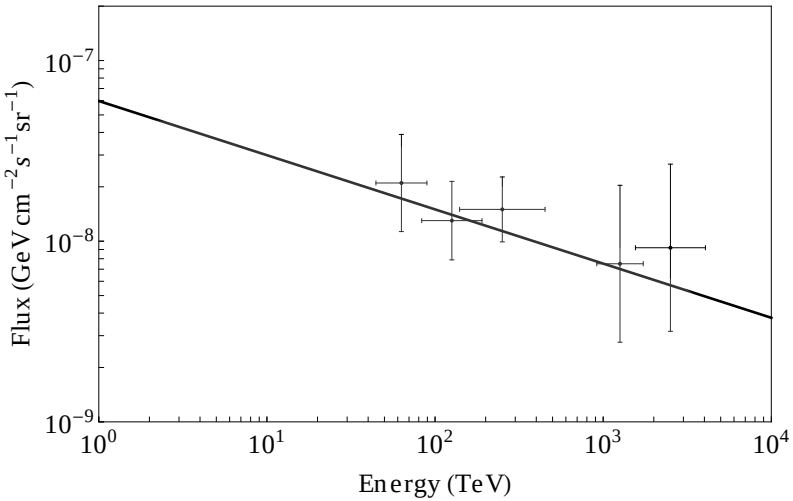
IceCube results(arXiv:1405.5303)



(a)



(b) $E^2\phi(E) \propto E^{-0.3}$

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- We consider two types of stellar remnants:
  - **Supernova remnants (SNRs)**
    - CR sources
    - Capable of generating ν flux up to 100$-$150 TeV
  - **Hypernova remmants (HNRs)**
    - Small fraction of SNRs ($1\backsimeq$ %) with extreme energetic ejecta
    - Capable of generating ν flux up to 1$-$10 P eV

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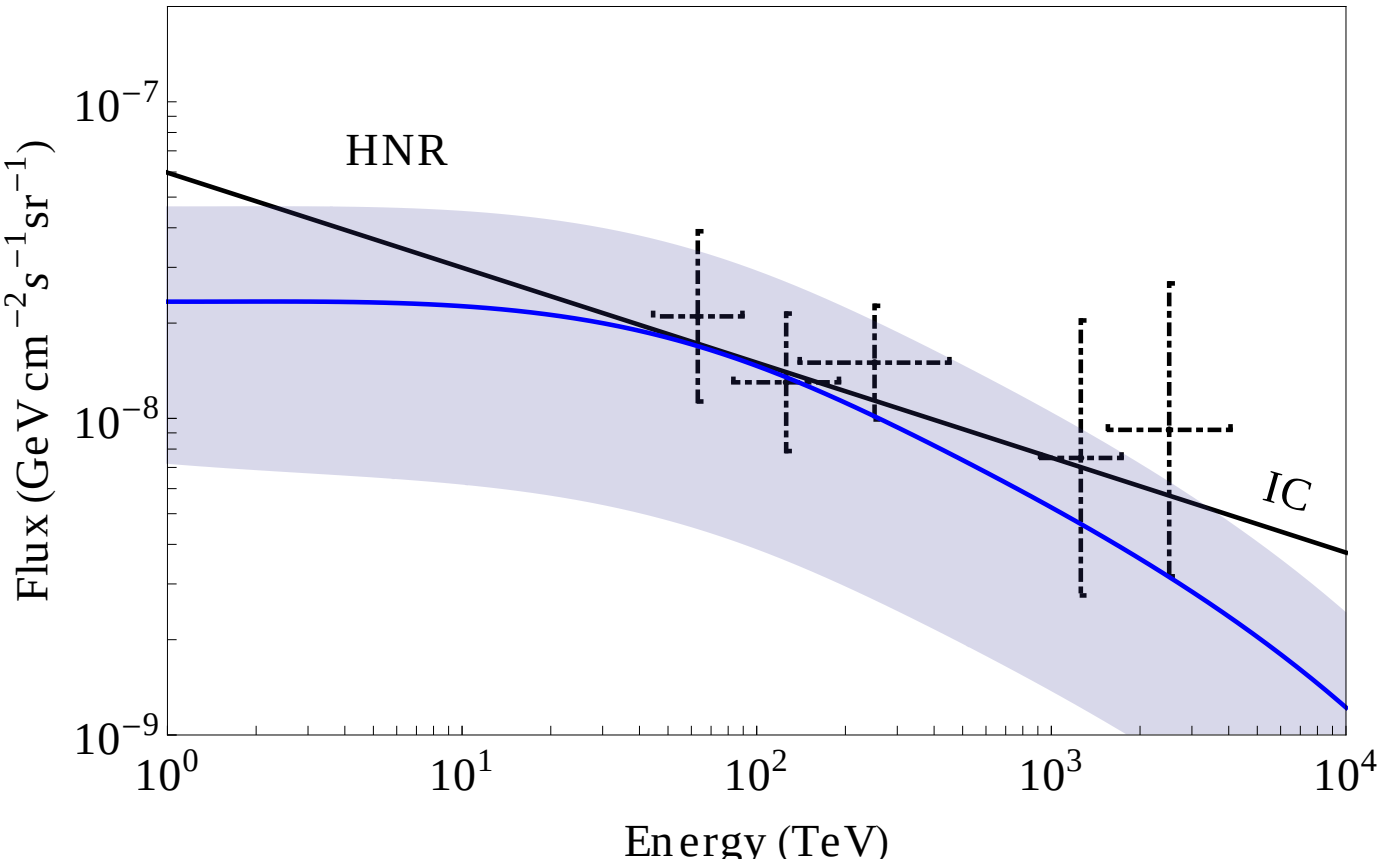
2. Star burst galaxies (SBGs)
   - Old, Metal poor galaxies (z$\backsimeq$1-2)
   - Relative rate of SBGs $\rightarrow$ (10-20)% of the NSFGs
   - Galaxies with a high SFR
   - High $n_p(n = 10^2\text{cm}^3) \rightarrow$ high efficiency for ν production

SNR and HNR in NSFG's+SBG's neutrino flux



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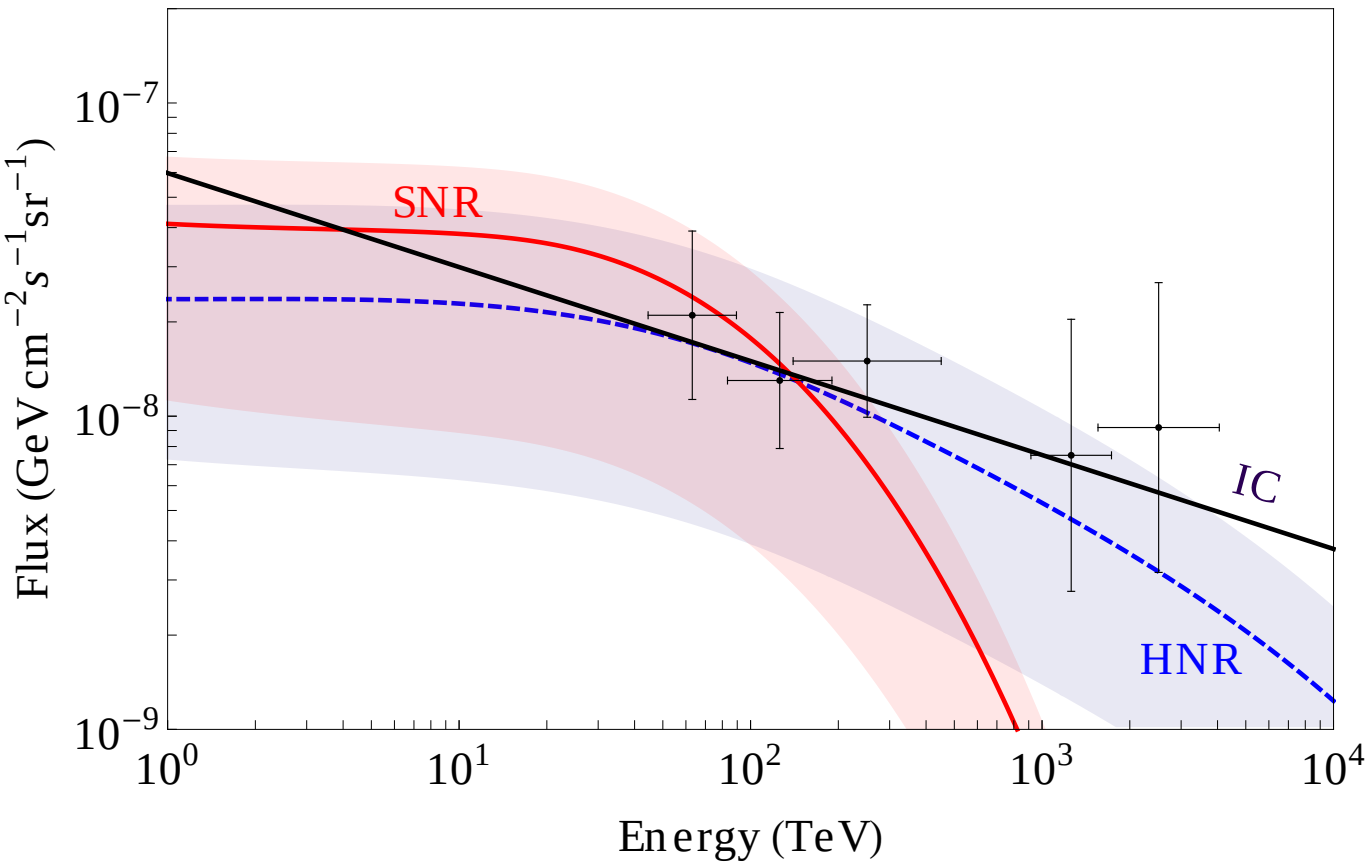

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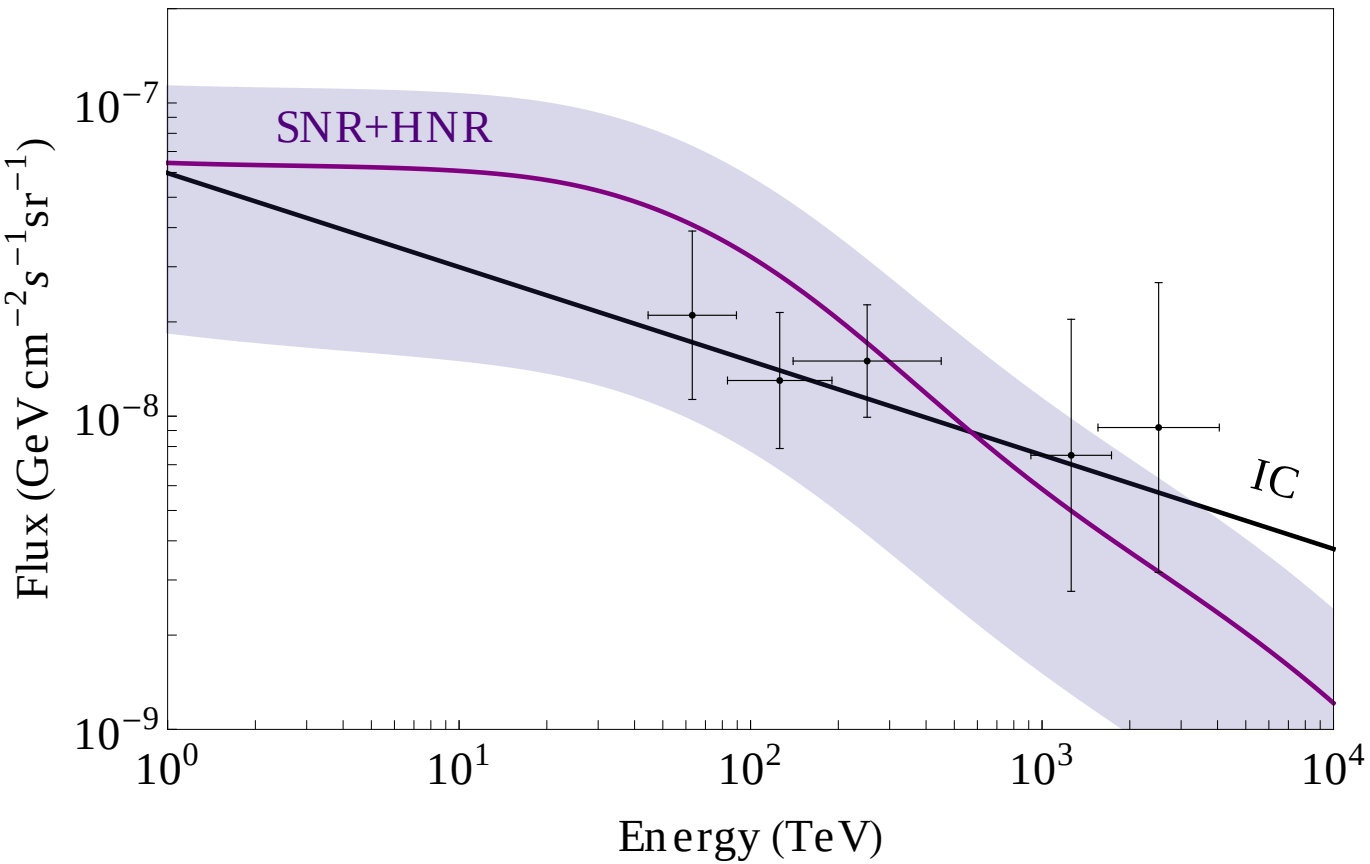


Conclusions

- Diffuse neutrino flux might have a (dominant) stellar remnant origin
  - SNRs-HNRs in NSFGs-SBGs are plausible candidates

    ▶ The SNR ν flux will be dominant at $\simeq$ 100 TeV energies

    ▶ **The SNR-HNR in NSFGs-SBGs ν dominated flux scenario will result in a break on the spectrum**

Thank you for your attention

Back up slides

η_π:SBGs vs NSFGs

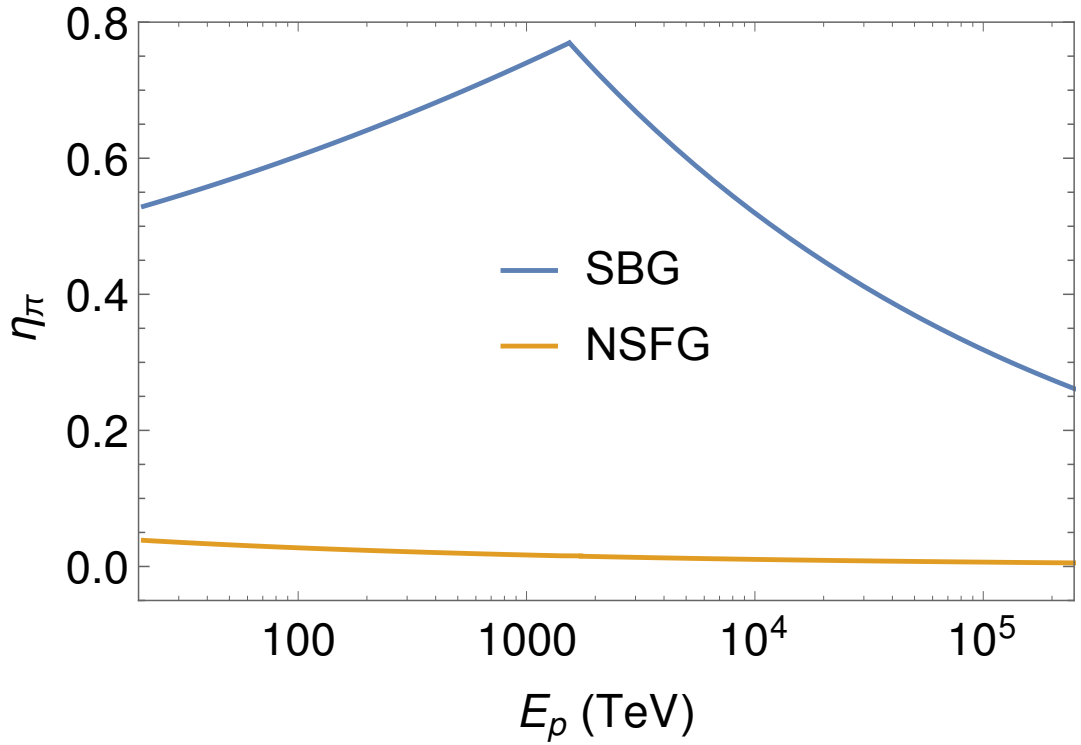
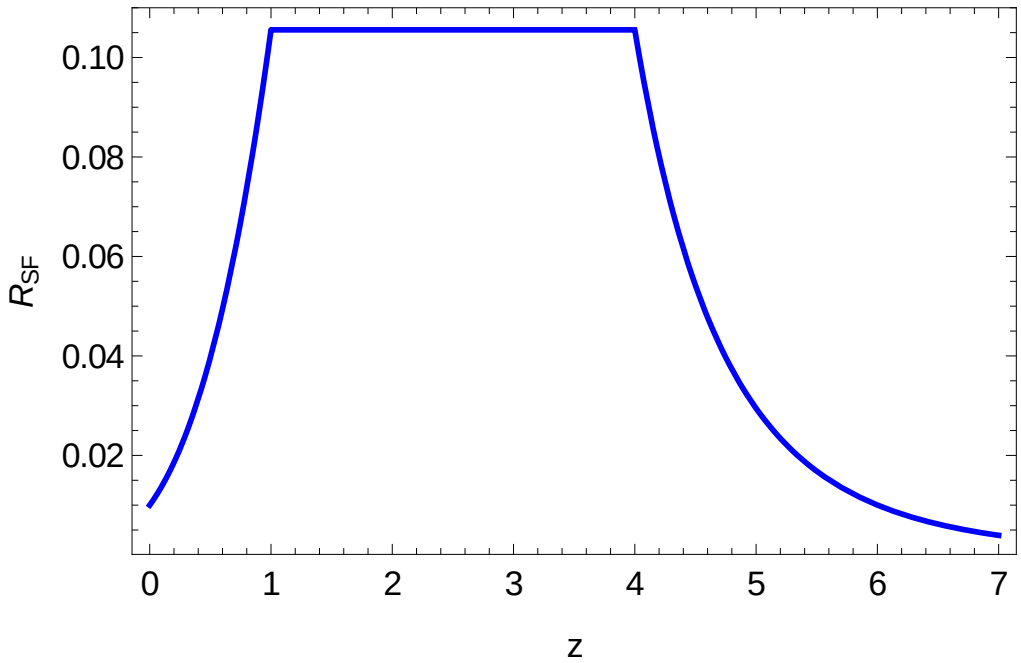
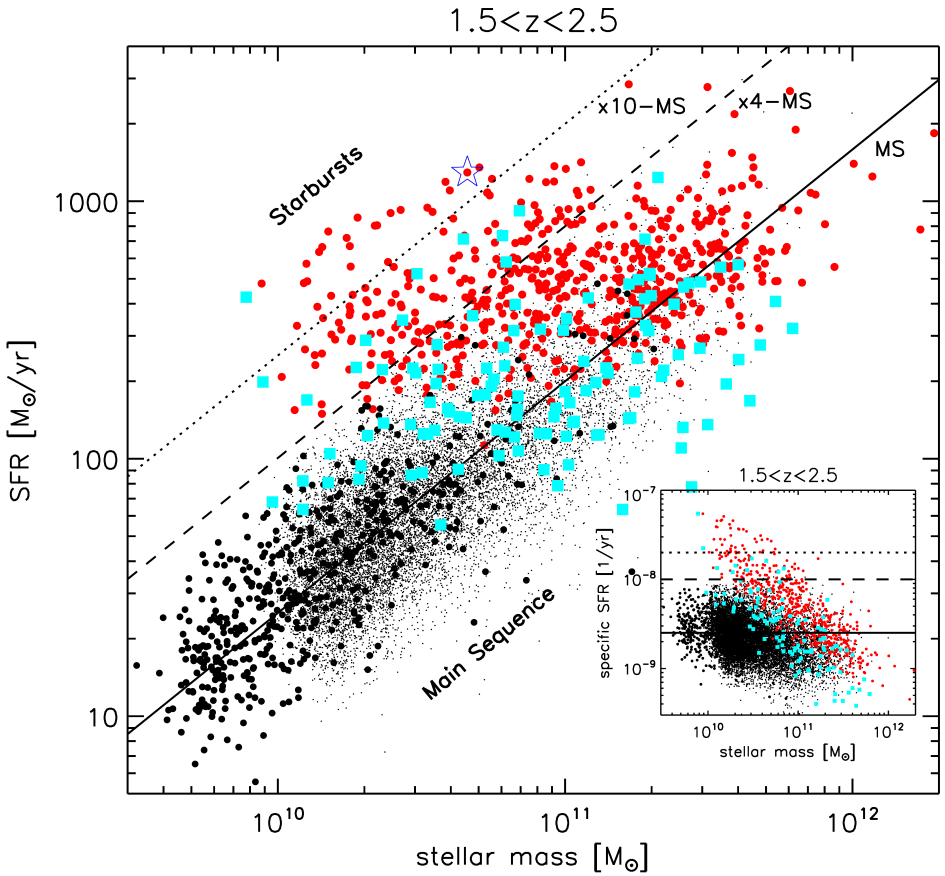


Figure: ν's production efficiency (η_π) as a function of the proton energy

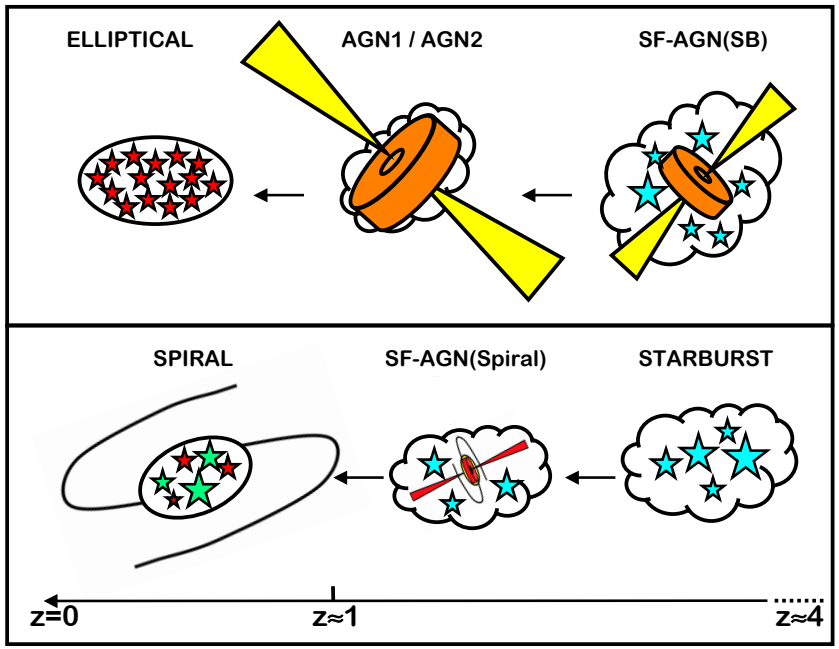
R_{SF} as a function of z



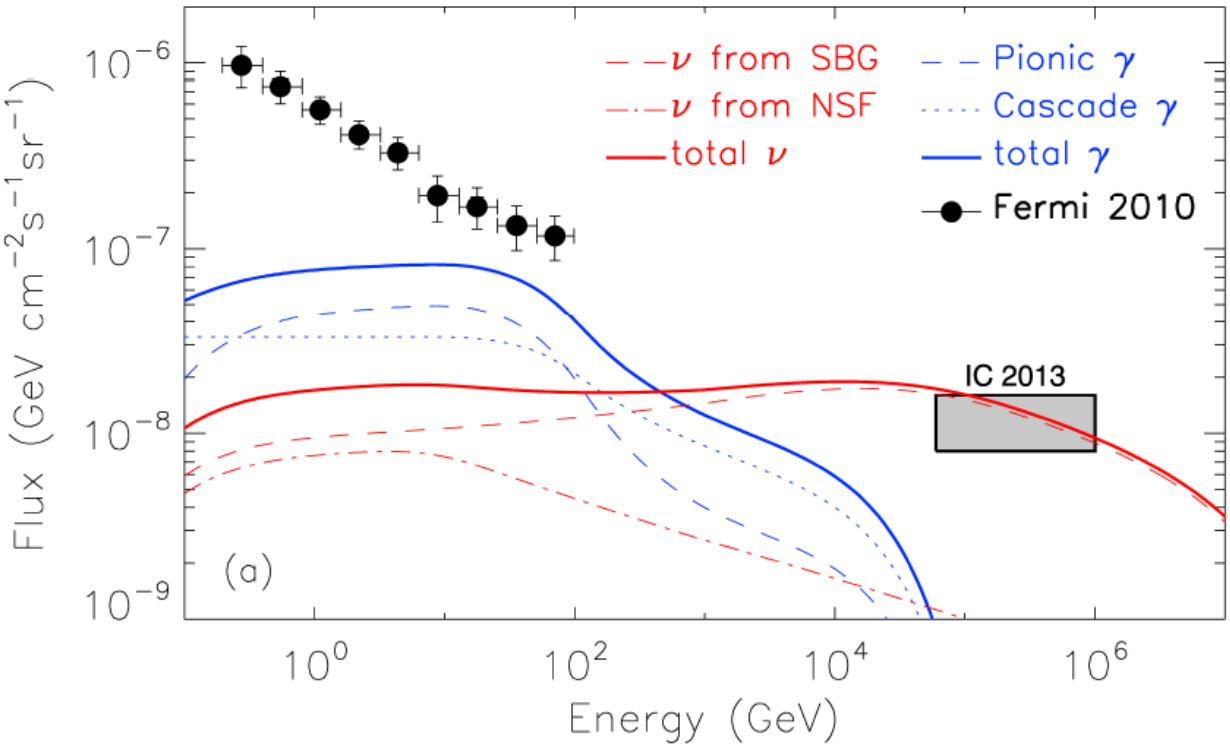
SBGs


1.5<z<2.5
x10−MS
x4−MS
MS
Starbursts
Main Sequence
SFR [M⊙/yr]
1000
100
10
10^10
10^11
10^12
stellar mass [M⊙]
1.5<z<2.5
specific SFR [1/yr]
10^-7
10^-8
10^-9
10^10
10^11
10^12
stellar mass [M⊙]

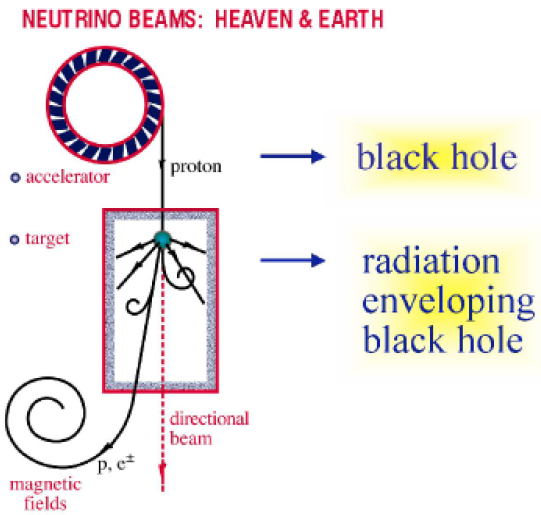
SBGs


ELLIPTICAL
AGN1 / AGN2
SF-AGN(SB)
SPIRAL
SF-AGN(Spiral)
STARBURST
z=0
z≈1
z≈4

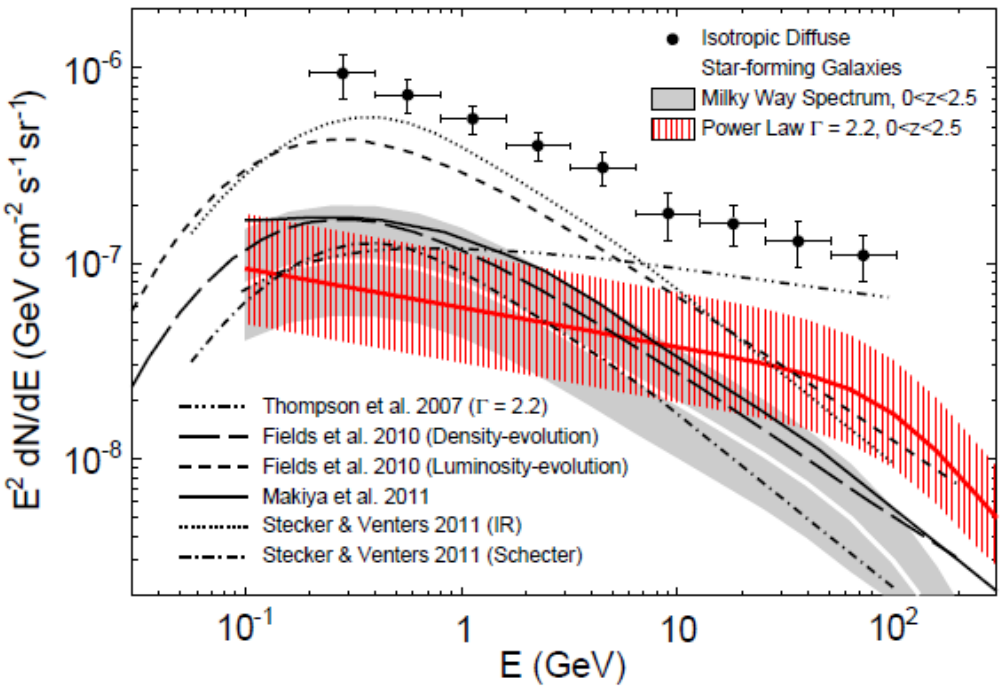
HNRs in SBG neutrino flux (arXiv: 1310.1362)



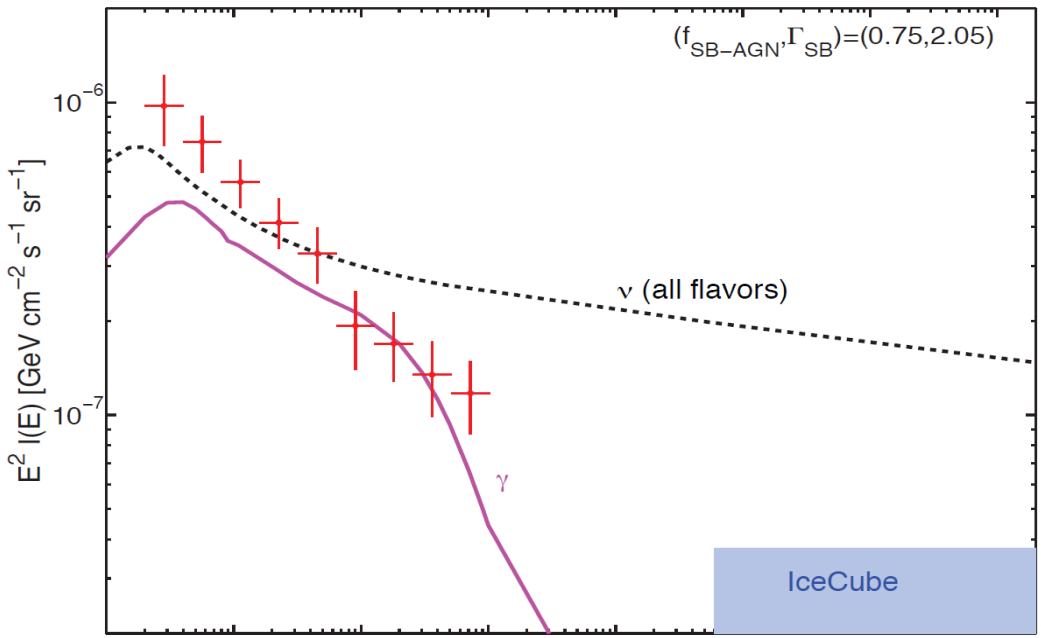
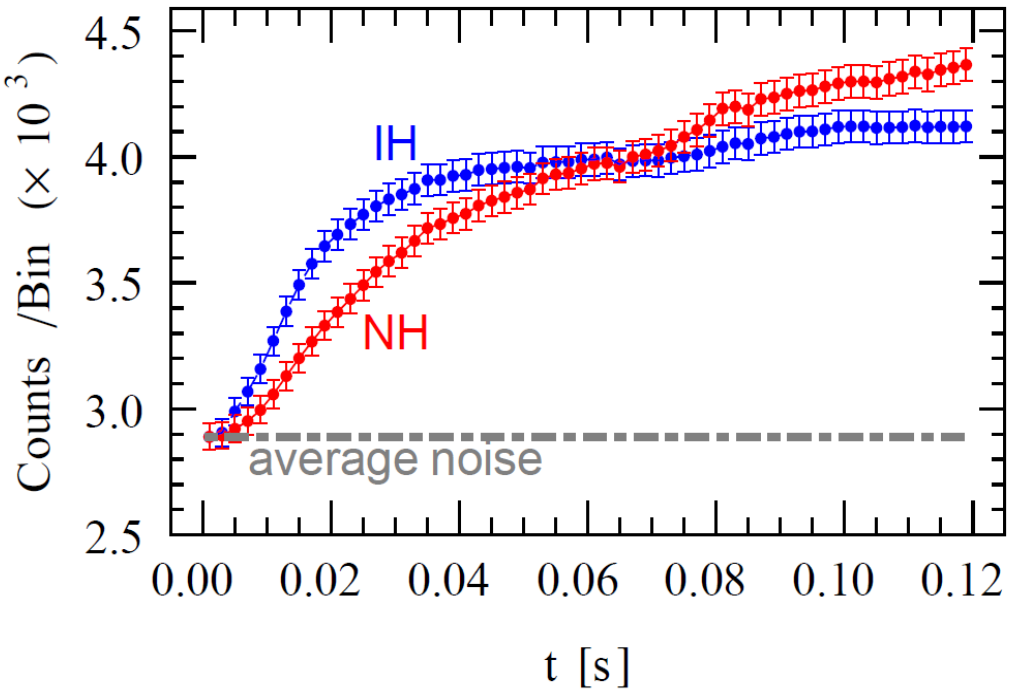
SBGs


NEUTRINO BEAMS: HEAVEN & EARTH
accelerator
proton
target
black hole
radiation
enveloping
black hole
directional
beam
p, e±
magnetic
fields

Fermi γ ray flux



Fermi γ ray flux



SN ν at IceCube