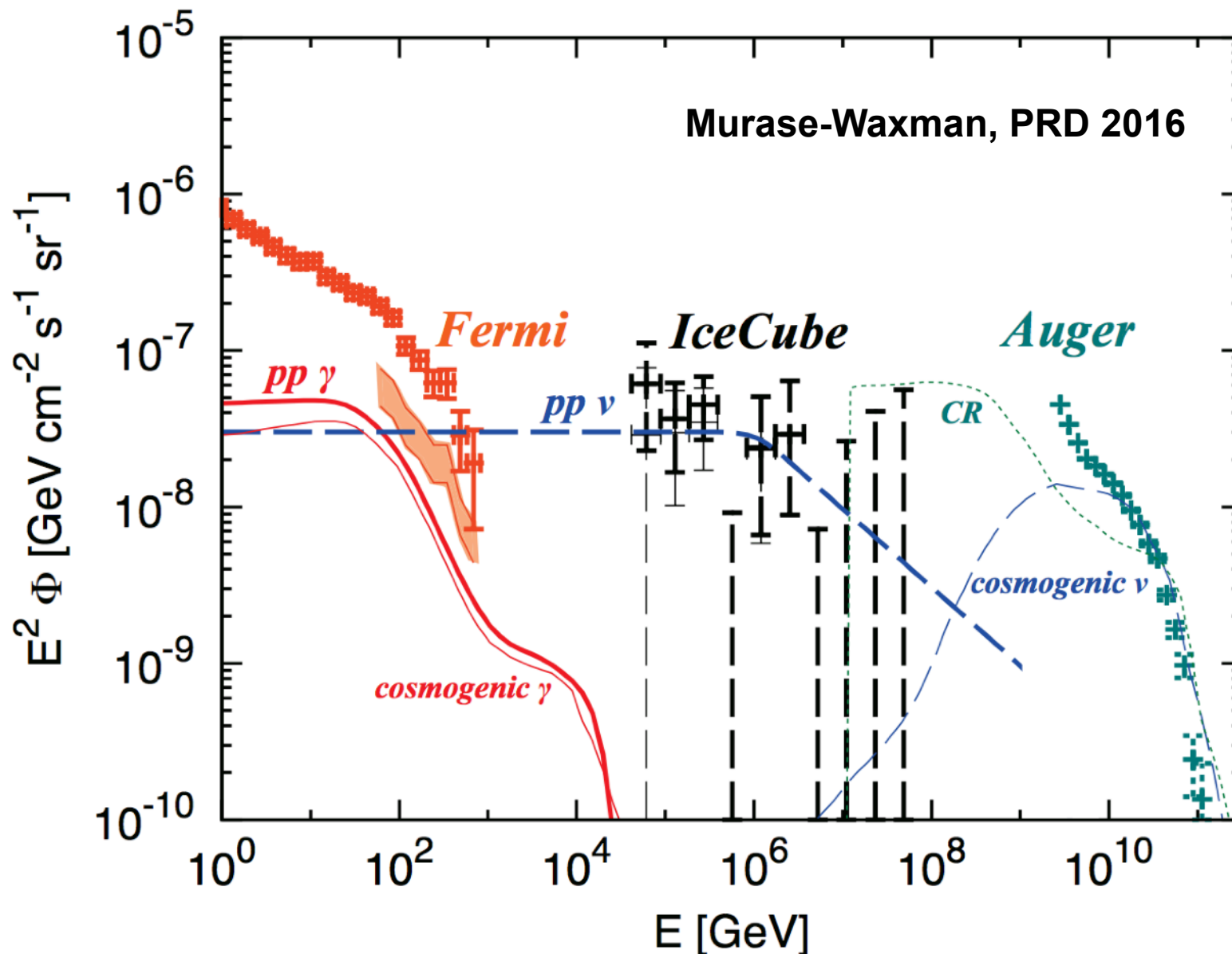# Multi-messenger connection between neutrinos, gamma-rays and cosmic rays
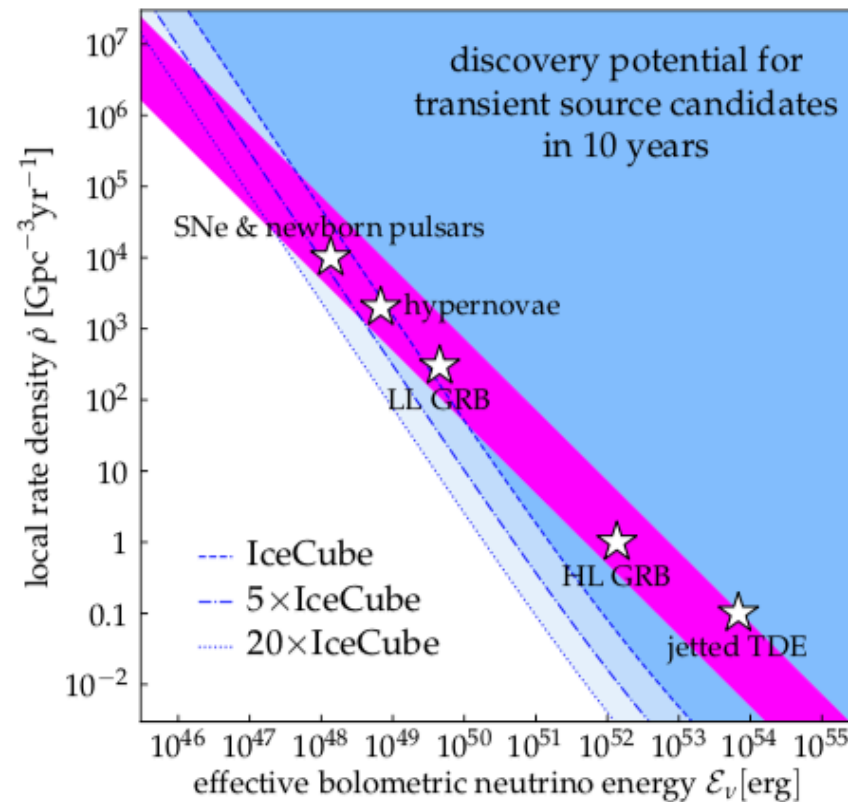
Tavola rotonda
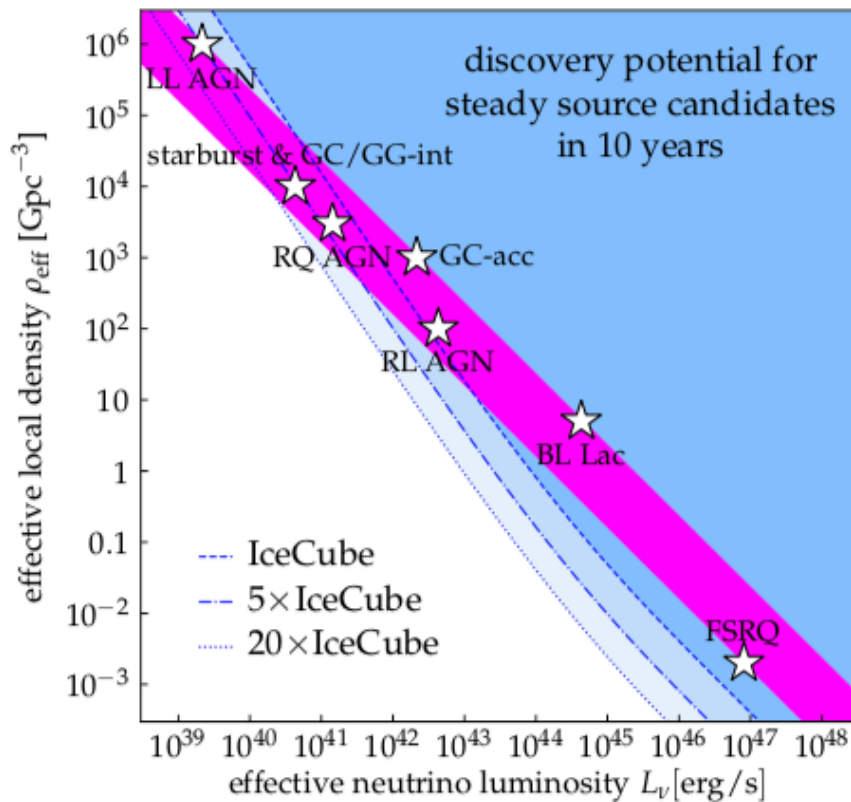
28.11.2019, Catania (Italy)

Andrea Palladino
Desy, Zeuthen

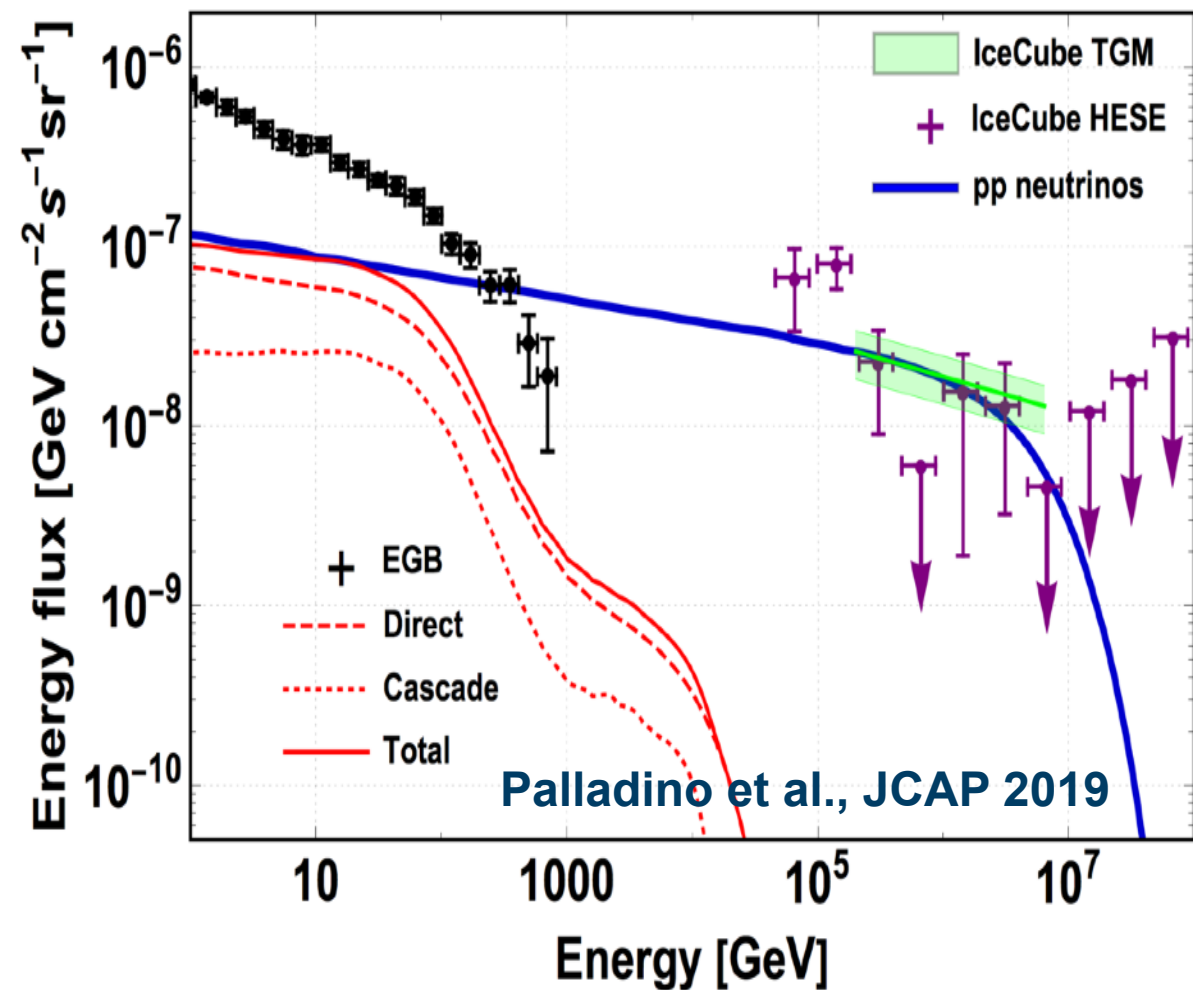# Budget energetico simili per neutrini, gamma e raggi cosmici
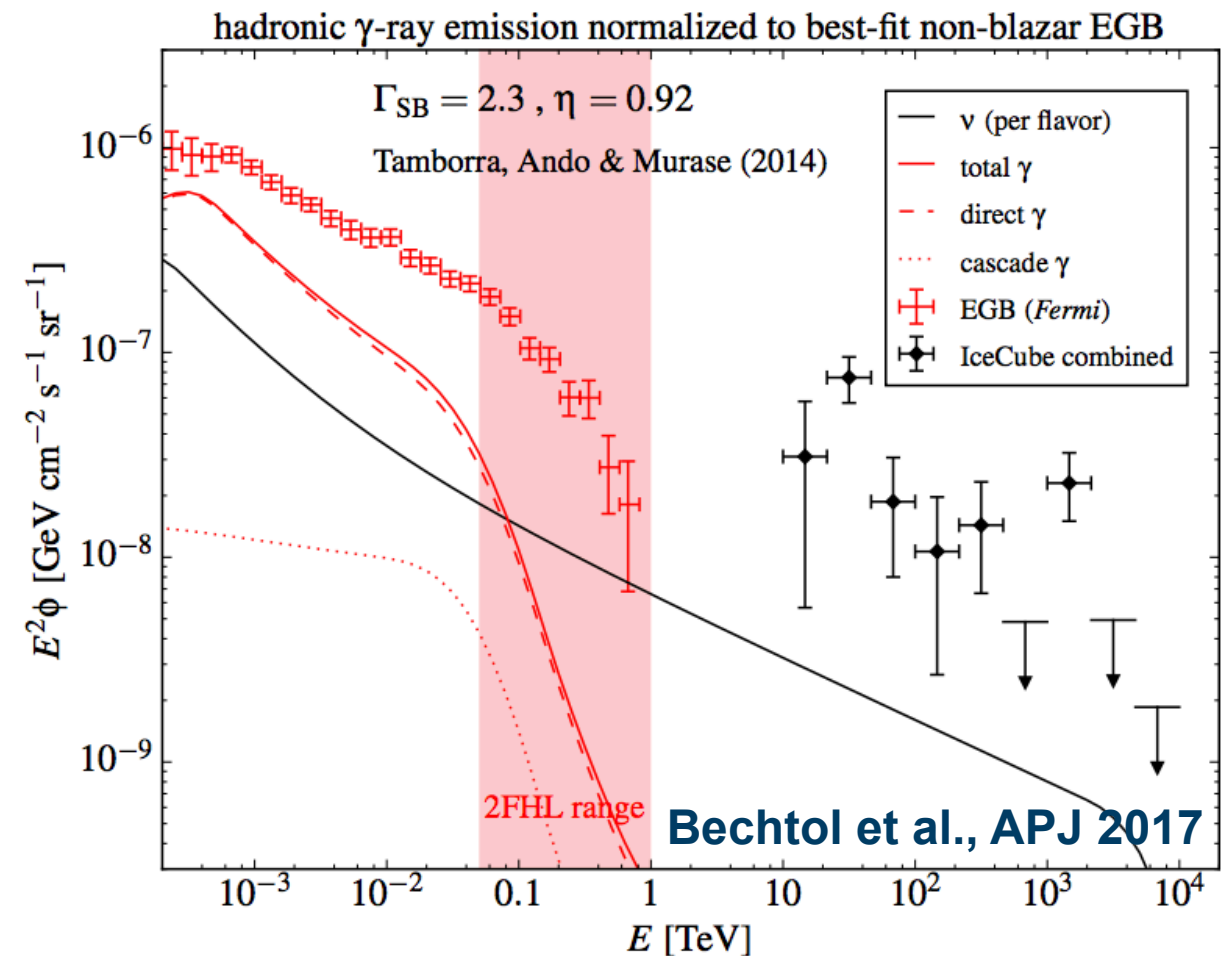

Murase-Waxman, PRD 2016

2

What about the origin ?

Ackermann et al., arXiv: 1903.04334

- **The absence of multiplets in neutrino data favors abundant and faint sources**
- **Up to now only 1 neutrino has a (confirmed ?) counterpart, the Blazar TXS 0506+056**
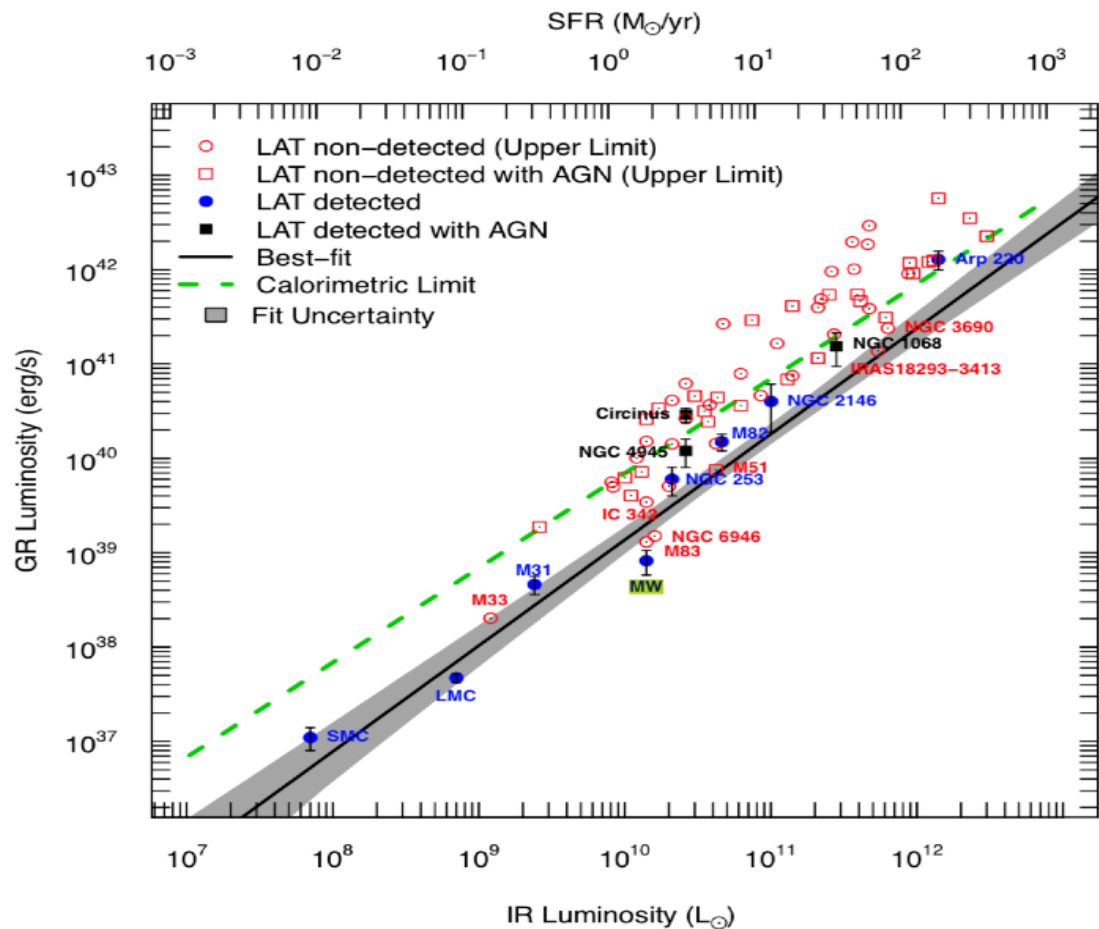
Neutrino and gamma-rays. Starburst

Maximum contribution to the neutrino flux. 10% on the left panel, dominant contribution on the right panel

Infrared connection

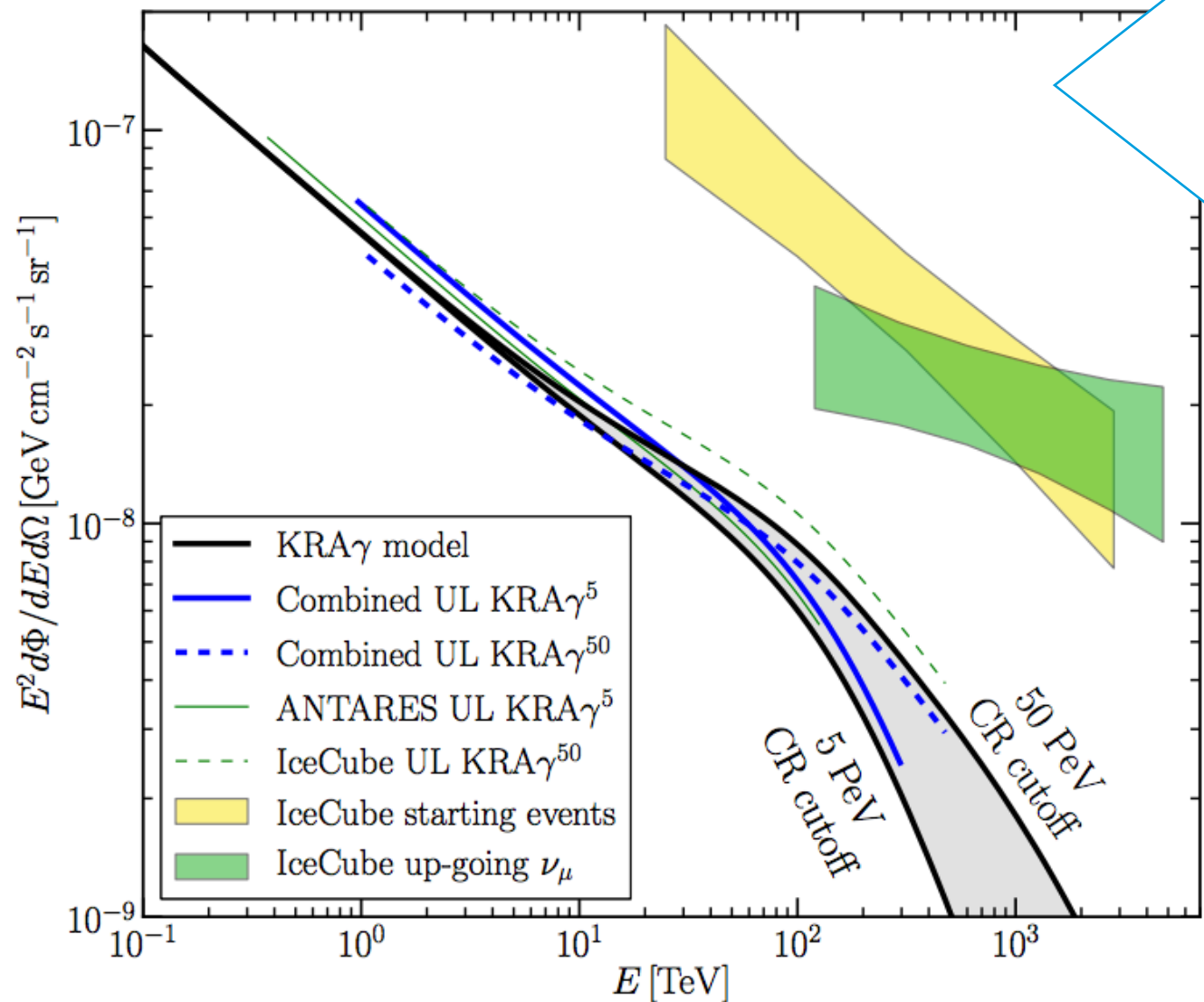**From Tamborra et al., JCAP 2014**

Infrared -> Gamma -> Neutrinos

Search for connection using infrared catalogue ?

$$\log\left(\frac{L_\gamma}{\text{erg s}^{-1}}\right) = \alpha \log\left(\frac{L_{\text{IR}}}{10^{10}L_\odot}\right) + \beta\,, \qquad (2.4)$$

with $L_\odot$ the solar luminosity, $\alpha = 1.17 \pm 0.07$ and $\beta = 39.28 \pm 0.08$ [5]. While this parame-

Galactic neutrinos

Connection between Galactic cosmic rays and high energy neutrinos.

How much is the IceCube limit sensitive to the template of the neutrino spectrum ?

Can KM3NeT solve the challenge and measure the flux of Galactic neutrinos ?

IceCube-ANTARES, APJ 2018

All flavor vs throughgoing muons

We always talk about volume and effective areas. But what about the angular resolution ?

If KM3NeT can really reach 2° of angular resolution with showers, it gains (roughly) a factor 3 in the exposure, since it can use showers to point sources

Muon neutrino fraction at Earth
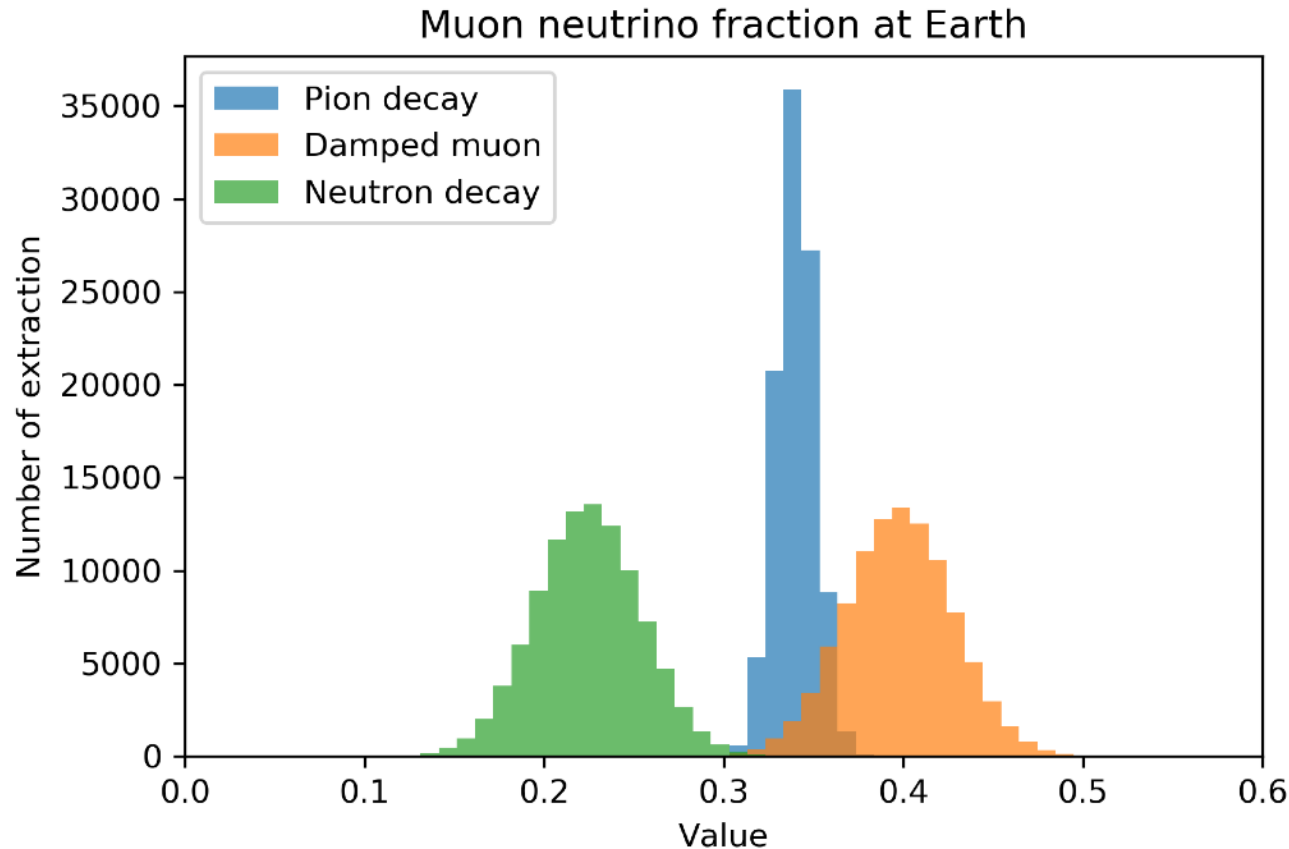
This is simply due to neutrino oscillations. Whatever is the production mechanism, the all flavor flux is 2.5 - 5 times larger than the throughgoing muon flux