THE NEUTRINO FILTER: CONNECTING BLAZARS WITH ULTRA HIGH ENERGY COSMIC RAYS AND ASTROPHYSICAL NEUTRINOS

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ICECUBE NEUTRINOS

All HE neutrinos, 6 - 7 years

All HE neutrinos, \( E \geq 60 \text{ TeV} \) & \( \theta \leq 20^\circ \)

The IceCube Coll, PoS(ICRC2017) 998
HIGH ENERGY SOURCES: 3FHL

Third Catalog of Hard Fermi-LAT Sources (3FHL)
e-Print: arXiv:1702.00664

3FHL, all

[A. Dominguez, highlight talk, ICRC2017]

3FHL, HBL
Y.L Chang, B. Arsioli, P. Giommi
Q1: NEUTRINOS WITH SOME (AT LEAST ONE) PHOTON COUNTERPART?

\[ \exists c(\varnothing_\nu) = \text{true} \]
Q1: NEUTRINOS WITH AT LEAST ONE H.E. COUNTERPART?

trial corrected: 1.4% (2.2σ)

[P. Padovani et al., MNRAS, 2016]
Q1: Neutrinos with at least one H.E. counterpart?

### Trial Corrected:
- **20%**
  - Preliminary

### Corrected:
- **0.28% (2.8σ)**
  - Preliminary
Q2: ARE NEUTRINO FILTERED SOURCES ALSO UHECR SOURCES?

$\nu \rightarrow \gamma$ $F_{\gamma}$ neutrino filter

$\not(\nu \rightarrow \gamma)$ $F_{\gamma}$ complement
NEUTRINO FILTER
NEUTRINO FILTER TO UHECR
NEUTRINO FILTER TO UHECT: PROBABILITIES

2FHL, 4 years HESE, 2.9 \(\sigma\) (trial corrected)
NEUTRINO FILTER TO UHECT: PROBABILITIES

3FHL, 4 years HESE, 3.35 \( \sigma \) (trail corrected)

- Neutrino filter \((\nu \rightarrow \gamma)\)
- Complement filter \((\nu \rightarrow \gamma)\)

\[
\begin{align*}
\text{All, } F_\nu \geq 0.13 \times 10^{-9} & \quad \text{red line} \\
\text{HBL, } F_\nu \geq 0.13 \times 10^{-9} & \quad \text{blue line} \\
\text{HBL and Uncl., } F_\nu \geq 0.13 \times 10^{-9} & \quad \text{orange line} \\
\text{Non Blazars, } F_\nu \geq 0.84 \times 10^{-10} & \quad \text{purple line}
\end{align*}
\]
NEUTRINO FILTER TO UHECT: PROBABILITIES

3FHL, 6 years HESE, 2.3 $\sigma$ (trial corrected)
NEUTRINO FILTER TO UHECR BEST
SUMMARY

- The IceCube neutrinos are a natural challenge
- The 3FHL strengthen the hint of a possible connection neutrinos - HBLs
- Hint not confirmed with the new HESE data
- Neutrino filter effective to pin down candidates for UHECRs
- The new years of HESE show an under-fluctuation
- Interesting but inconclusive
  - more data needed!!