

TASK 3b 4 plan

Events \equiv Ice-cube Source \equiv ms Psr

LUO& ZHANG - 2004.09686

- 1) Select ν events ≥ 100 TeV

$$\Rightarrow \log_{10} E/GeV \geq 5$$

Pulsar

- 2) . Select D events with \angle^{le} to interesfed source $< 20^\circ$

- 3) $B_i =$ events in dataset with solid \angle^{le} arerage across a band of $\pm 6^\circ$ in the declination around the source Solid L'

- 4) $S_i = \frac{1}{2\pi\sigma_i} = \exp\left(-\frac{|\bar{x}-\bar{x}_s|^2}{2\sigma_i^2}\right)$
 σ_i is uncertainty associated with each event
 $\sigma_i = A_{\text{ingers of } i^{\text{M}} \nu\text{-event in } C \text{ data}}$

- 5) Estimate the B.G PDF by calculating Hevents per-steradian

Total events

$|\bar{x}_i - \bar{x}_b|^2 = \text{spoce le b/w }^{\text{th}} \nu \& s^{\text{in}} \text{ msp 5. For a total } N \text{ events:}$

PDF for i^{th} event $\equiv p[i] = \frac{n_s}{N} S_i + \left(1 - \frac{n_s}{N}\right) B_i$
 $n_s =$ events accredited to the source
 $\rightarrow ??$

- 6) Likelihood Pu of entire dataset $= \mathcal{L}(n_s)$

$$\mathcal{L}[n_s] = \prod_{i=1}^N \frac{n_s}{N} S_i + \left(1 - \frac{n_s}{N}\right) B_i$$

n_s is determined by maximizing \mathcal{L}

- 7) Define a test statistic

$$TS = 2 \frac{\ln \mathcal{L}(\tilde{n}s_s)}{\ln \mathcal{L}(0)}$$

Equivalent to the ratio of 2 Hypotheses $H_1 =$
 Of all the N events, n_s are produced by the
interested source $H_0 =$

All the Nevents are Bockground Events.

The likelihood ratio will indicate how likely is that some of the ν - events can be attributed to the source we are trying to test the association with different ν -flux background PDF (B_i)

Avg now events per steradian - At Each Sedination Total Events

Paper uses events which hove a high Probabilities of being Cosmic.

Likel, hood ratio obterined \square

Relative measurement of how /ikely to reject Null hypothes

NuLL HyPotHEsis: ALL the observed ν -events around the interested source are NOT produced by that source

F_{ails} to indicate the level of significance \rightarrow of what 1

Improperly defines the contributions of n_s (fitted source events) to the association of ν -events.

\rightarrow i.e Diffinult to say which has stronger association.

Source with

Source with

more filted Source events Less fitted source events

lower likelihood ratio higher likelihood ratio. \therefore
For Each source with n_s , $TS > 0$ Monte Carlo Simulation

Randomly generate ν events isotropically distributed around the interested source within 20° distance.

\downarrow

Assign E to all gen events using

Kernel density Estimation of the Observed ν Energy-Dist. of each year.

I \rightarrow from the relationship of Obs.Event" E Localization Error: f_n (simulated E , AngExr in ICDAPA)
1 Some Event selection Distribution of n_s , TS.

Linfer significance by L In the pupper, i11ler to Normol Dist. Compore with Observed result & find $\frac{p\text{-value}}{L}$ %tile observed values lie in