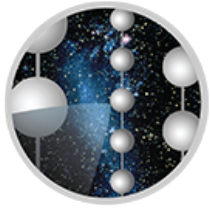
High-Energy Neutrinos from Core-Collapse Supernovae

Flash Talk

HELMHOLTZ
Young Investigators

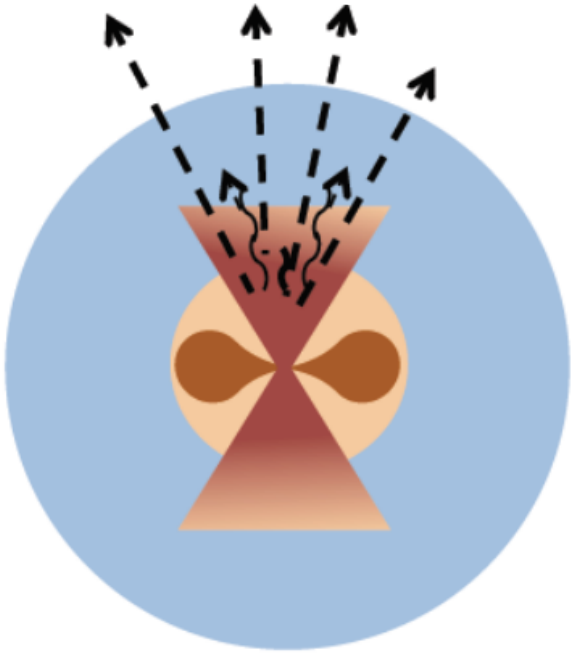


IceCube
South Pole Neutrino Observatory

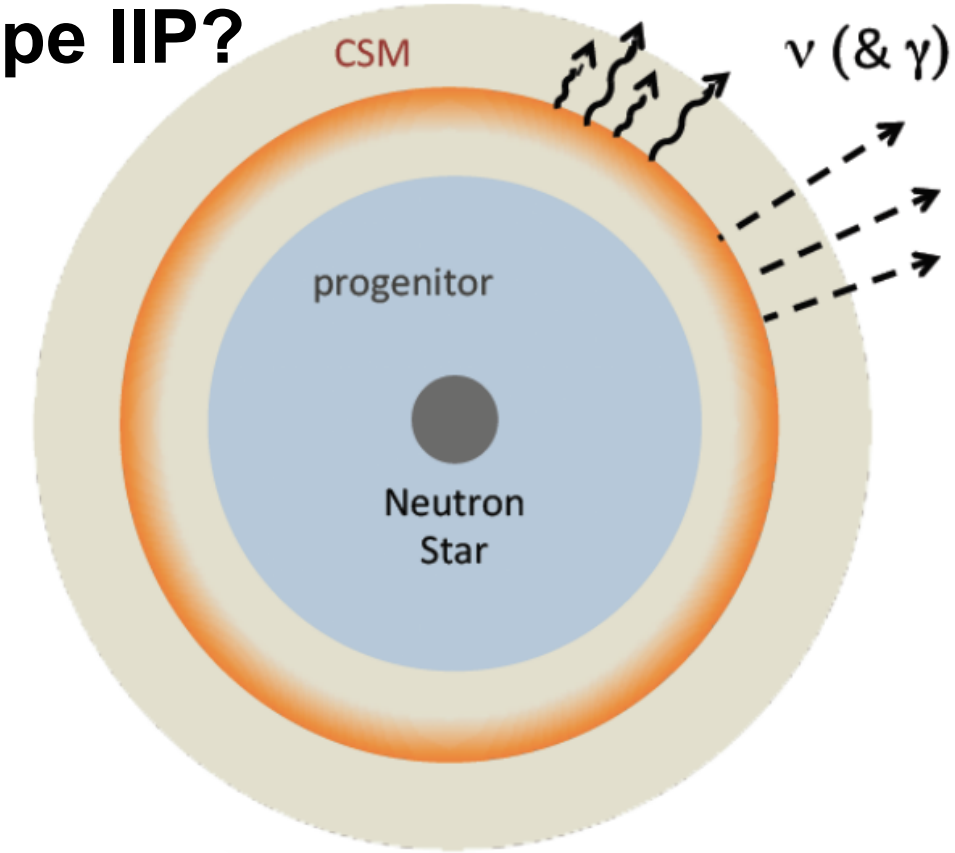
DESY.

High-Energy Neutrino Production

Type Ibc



Type IIn
Type IIP?



Credit: Kowalski&Bartos [1]

Likelihood Analysis

Supernova Catalogue

- assembled from Open Source Catalogues: 387 IIn, 167 IIP, 824 Ibc
- extracted **high-quality, nearby subsample: 15 IIn, 20 IIP and 19 Ibc**

Neutrino Dataset

- „7-year Point Source Sample“
- high angular resolution, through-going **track events**
- April 2008 - May 2015

Likelihood

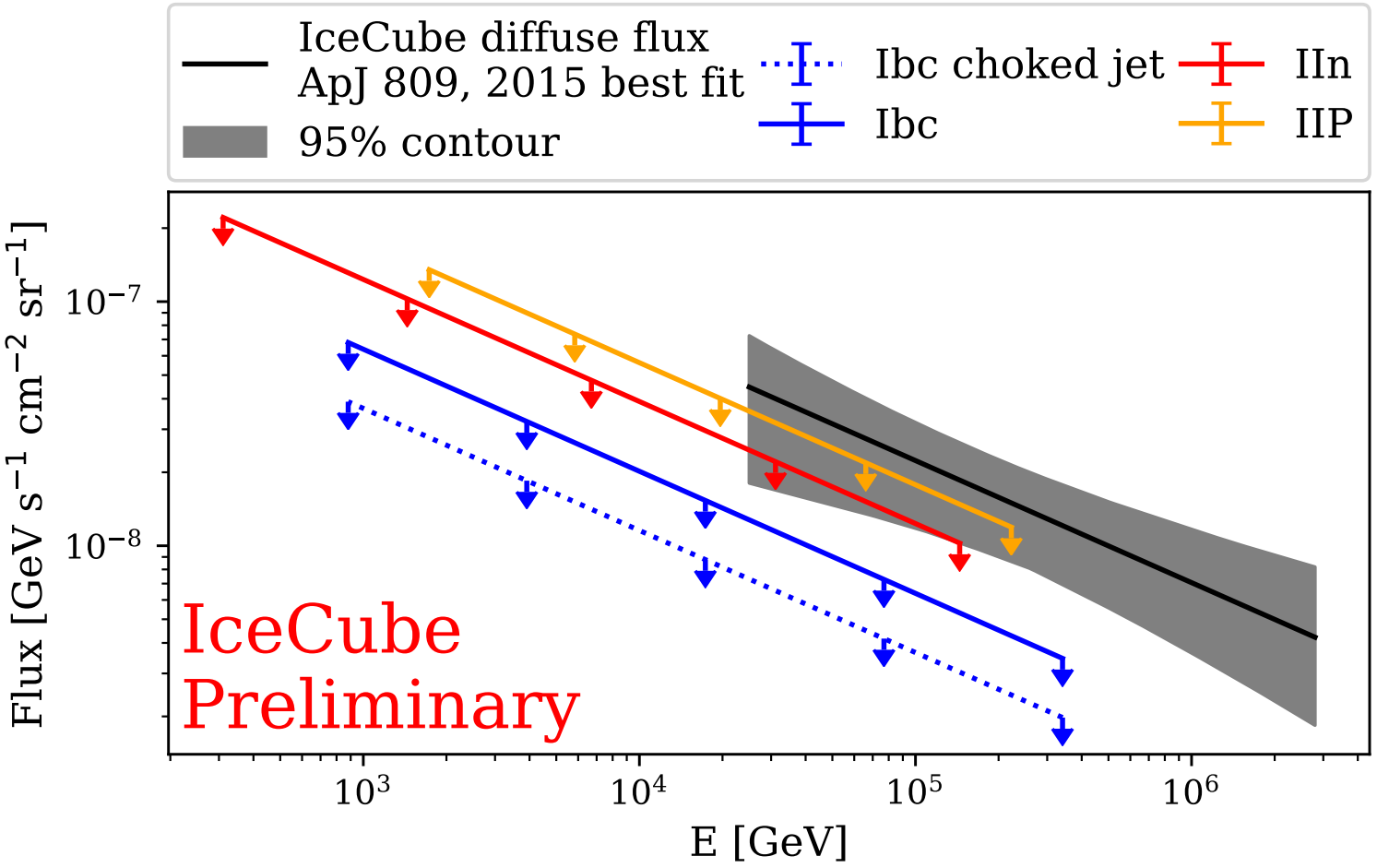
- **Stacking** M sources, looking for correlation with N neutrinos
- **free parameters**: spectral index γ, **number of neutrinos from each source**:

$$\vec{n_s} = (n_{s,1}, n_{s,2}, \ldots, n_{s,M})$$

$$\mathscr{L}(\vec{n_s}, \gamma) = \prod_{i=0}^{N} \left[\frac{1}{N} \sum_{j=0}^{M} n_{s,j} \cdot \mathcal{S}_j(\theta_i, \gamma) + \left(1 - \frac{\sum_j n_{s,j}}{N} \right) \mathcal{B}(\theta_i) \right]$$

Results

Limits on contribution to the diffuse flux assuming gamma=2.5



Ibc choked jet	16.4%
Ibc CSM interaction	28.6%
IIn CSM interaction	55.2%
IIP CSM interaction	79.6%