

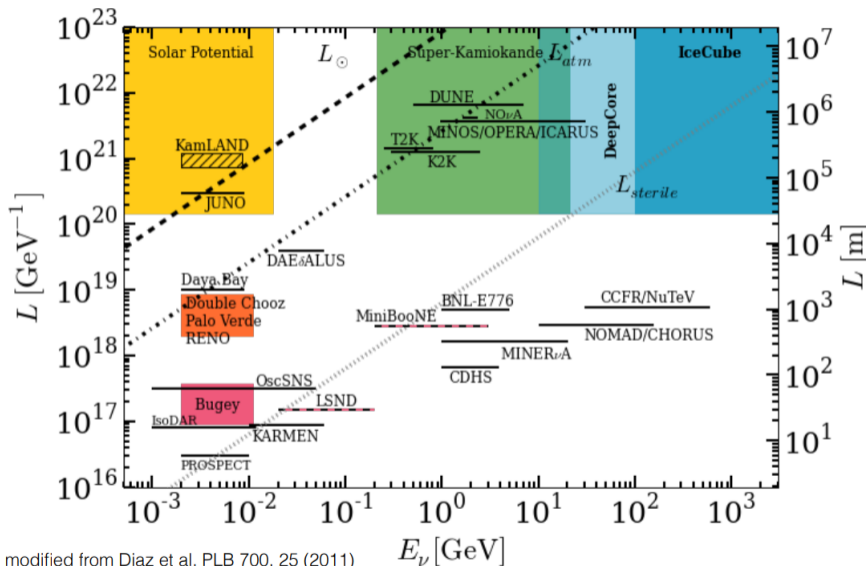
Sterile Neutrinos: IceCube Results

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for the IceCube Collaboration



October 2nd, 2018

IceCube/Short Baseline Connection

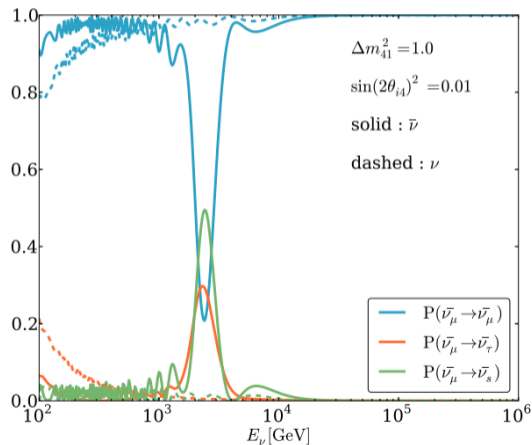


modified from Diaz et al. PLB 700, 25 (2011)

Resonance Effects

- In the Earth, for sterile neutrinos of $\Delta m^2 = \mathcal{O}(1 \text{ eV}^2)$ there is a matter-induced (parametric) resonant effect when:

$$E_{\nu}^{\text{res}} = \frac{\Delta m^2 \cos 2\theta}{2\sqrt{2}G_F N} \sim \mathcal{O}(\text{TeV})$$



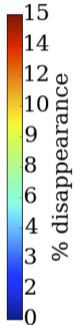
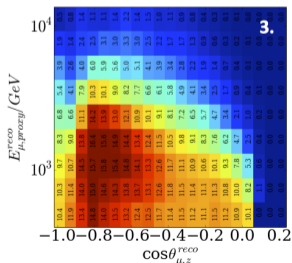
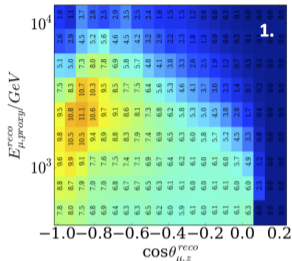
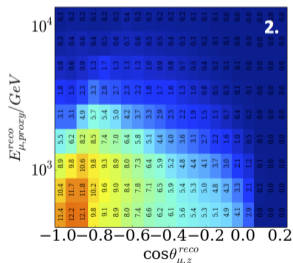
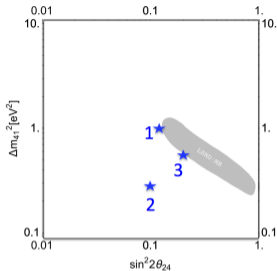
Sterile Neutrino: Signal

- Uses through going muon sample
 - ▶ only up-going ν_μ
 - ▶ very pure ν_μ sample

- Assumes:

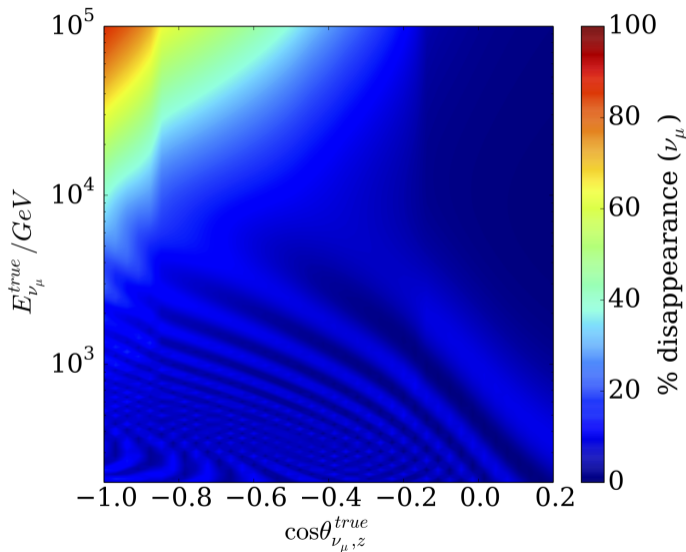
- ▶ $\Delta m_{41}^2 > 0$ (conservative)
- ▶ $|U_{e4}|^2 = 0$
- ▶ $|U_{\tau 4}|^2 = 0$ (conservative)

- Measures $|U_{\mu 4}|^2 = \sin^2 \theta_{24}$ as a function of Δm_{41}^2

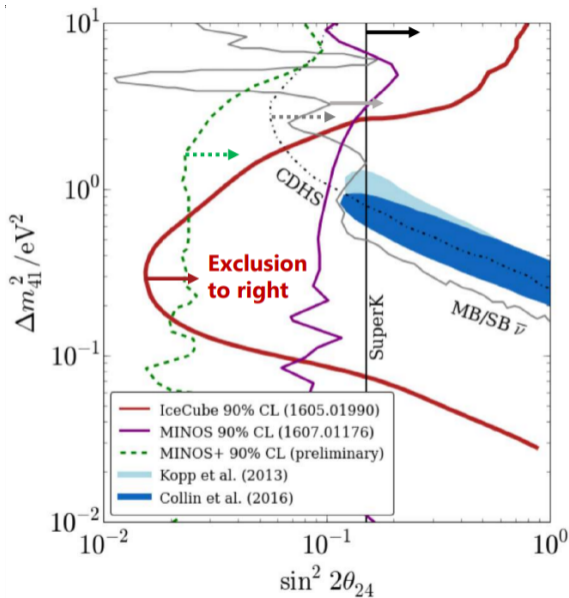
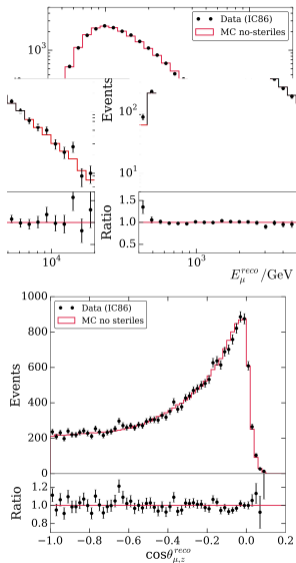


Sterile Neutrino: No Signal

- Uses through going muon sample
 - ▶ only up-going ν_μ
 - ▶ very pure ν_μ sample
- Assumes:
 - ▶ $\Delta m_{41}^2 > 0$ (conservative)
 - ▶ $|U_{e4}|^2 = 0$
 - ▶ $|U_{\tau 4}|^2 = 0$ (conservative)
- Measures $|U_{\mu 4}|^2 = \sin^2 \theta_{24}$ as a function of Δm_{41}^2



Results



Conclusions and Future Prospects

- First HE sterile neutrino measurement has been made by IceCube
 - ▶ Results consistent with no sterile neutrinos
 - ▶ Worlds best limits in part of the phase-space

- New results currently in progress
 - ▶ Will have 7 times the statistics of previous results
 - ▶ Better understanding and handling of many systematics
 - ★ New treatment of holeice, bulkice, and flux
 - ▶ Will include limits on $|U_{\tau 4}|^2$

THE ICECUBE COLLABORATION

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Vrije Universiteit Brussel

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