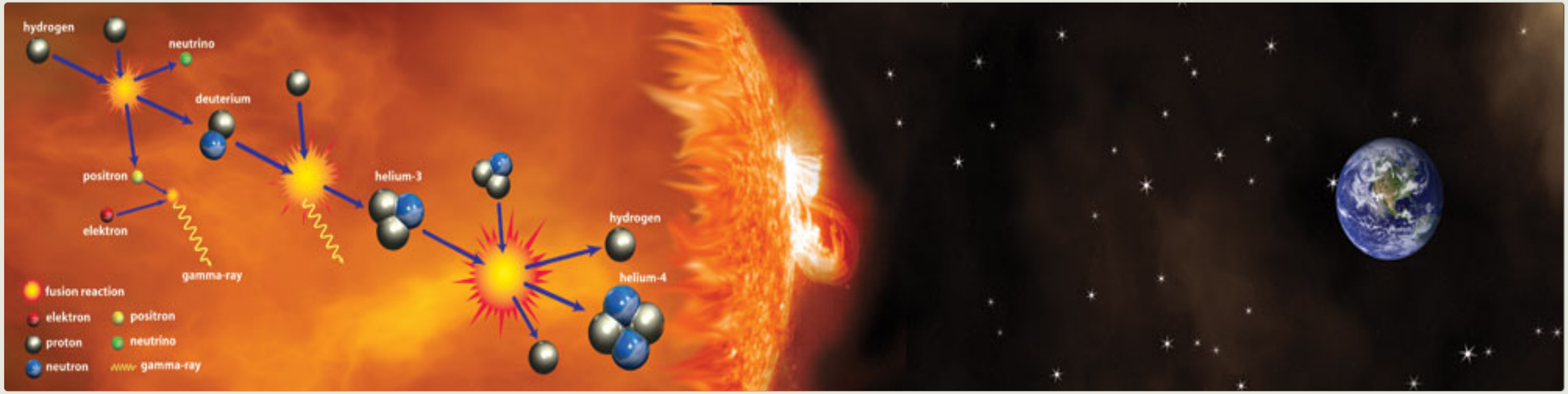


DUNE as the next-generation solar neutrino experiment

[arXiv: 1808.08232]

Guanying Zhu

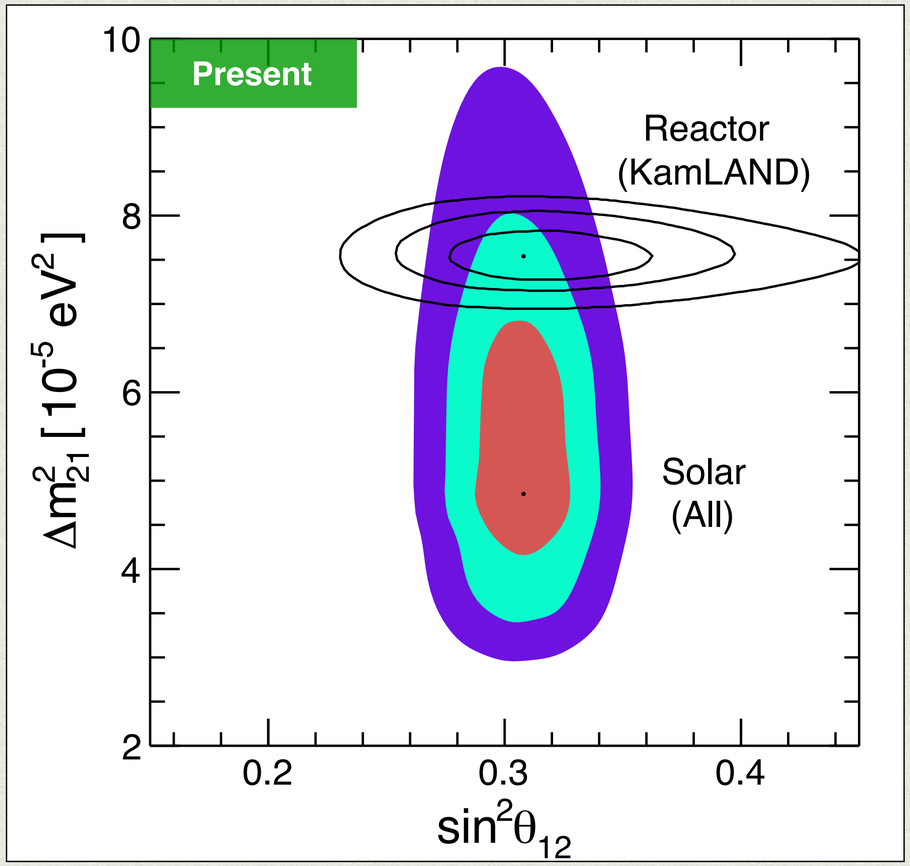
Collaborators: Francesco Capozzi, Shirley Li, John Beacom

CCAPP

The Ohio State University

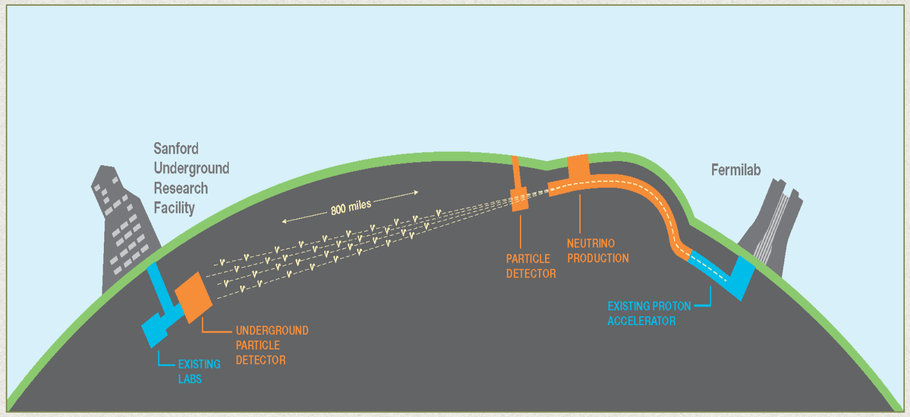
THE OHIO STATE UNIVERSITY

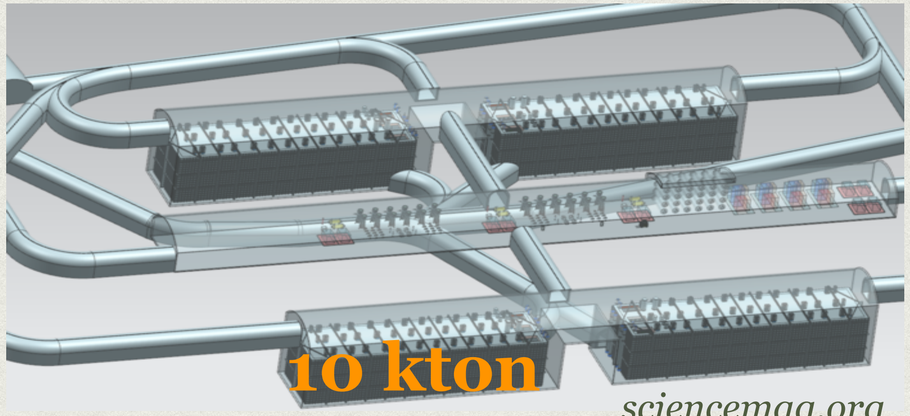
Solar & reactor tension ← new physics?



- Reactor: antineutrino, vacuum oscillation
- Solar: neutrino, matter-enhanced mixing

Deep Underground Neutrino Experiment





sciencemag.org

- 4 10-kton liquid argon TPC modules
- 2 modules deployed by 2024
- Detection channels:

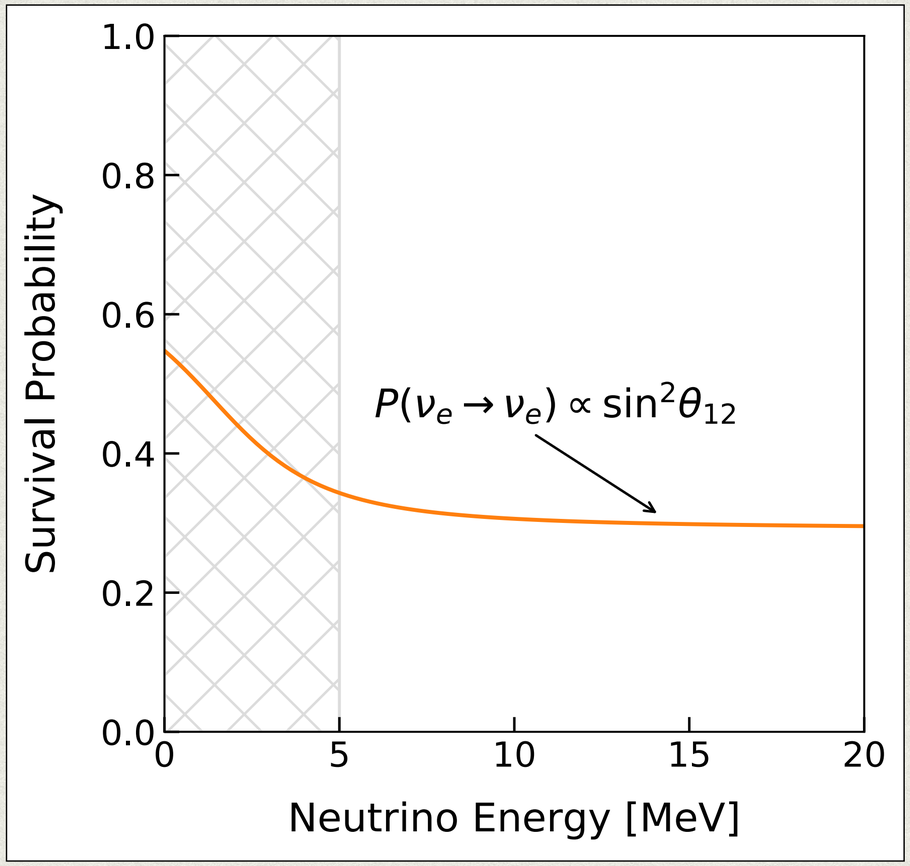
charged current $\nu_e + {}^{40}Ar \rightarrow e^- + {}^{40}K^*$

elastic scattering $\nu_e + e^- \rightarrow \nu_e + e^-$

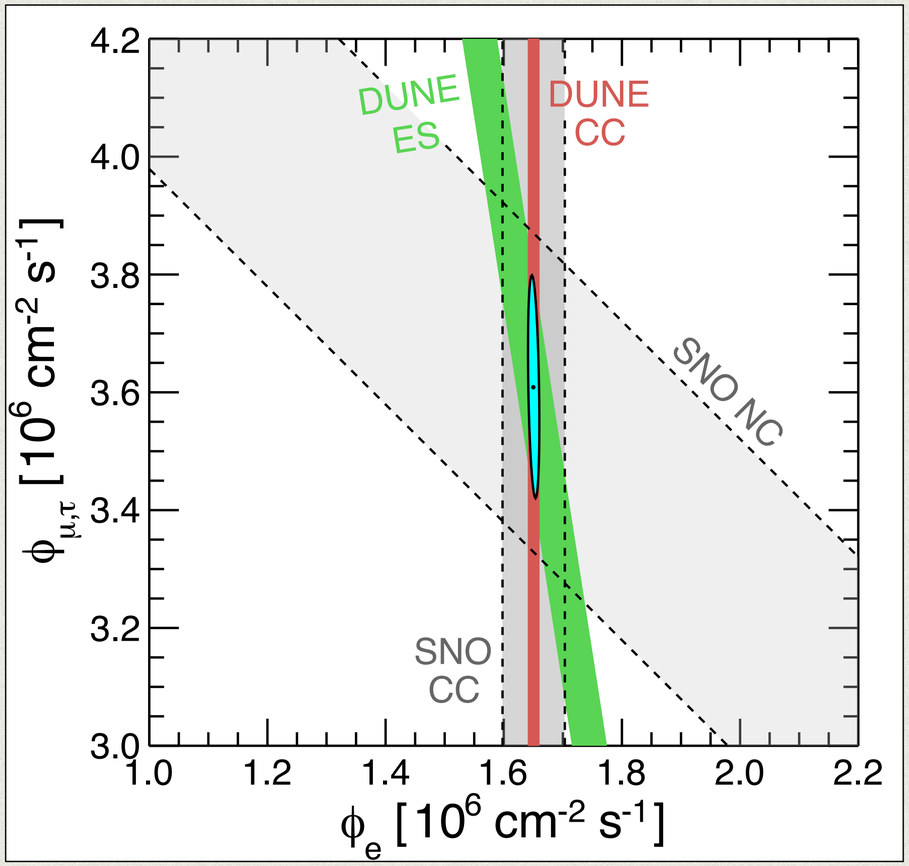
$\nu_{\mu,\tau} + e^- \rightarrow \nu_{\mu,\tau} + e^-$

Power of DUNE for solar physics, Part I

$$Rate \sim \Phi_\nu \times P \times \sigma$$

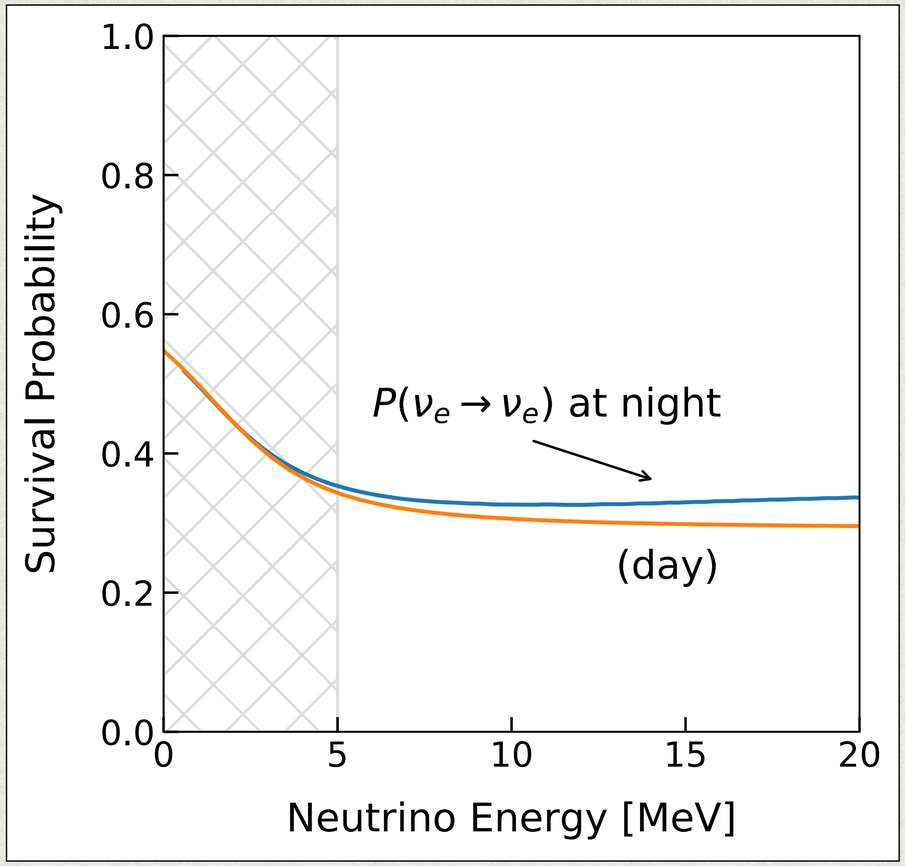


Isolate sin^2 with two channels



Power of DUNE for solar physics, Part II

$$\Delta P(\Delta m^2_{21}) \propto E_\nu$$



Isolate dm^2 with day-night

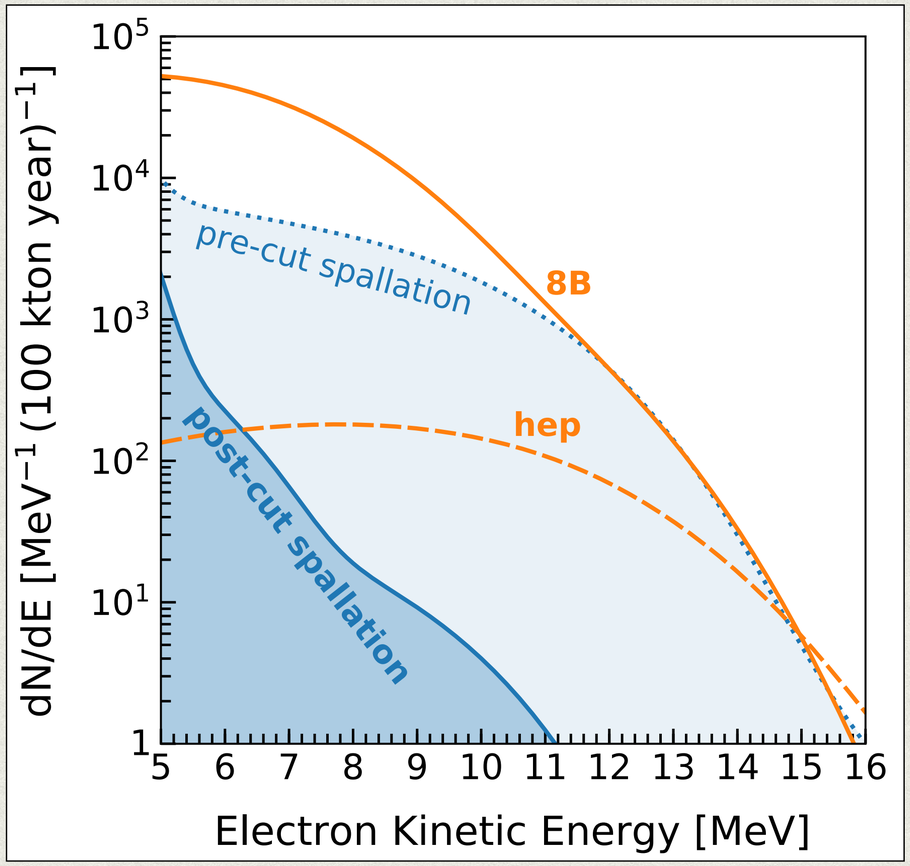
- Earth matter effect: P_night > P_day
- DUNE probes this difference efficiently

  Because: $\nu_e + {}^{40}Ar \to e^- + {}^{40}K^*$

  - Highlight higher E_ν
  - $T_e = E_\nu - Q - \Delta E$
  - Huge statistics

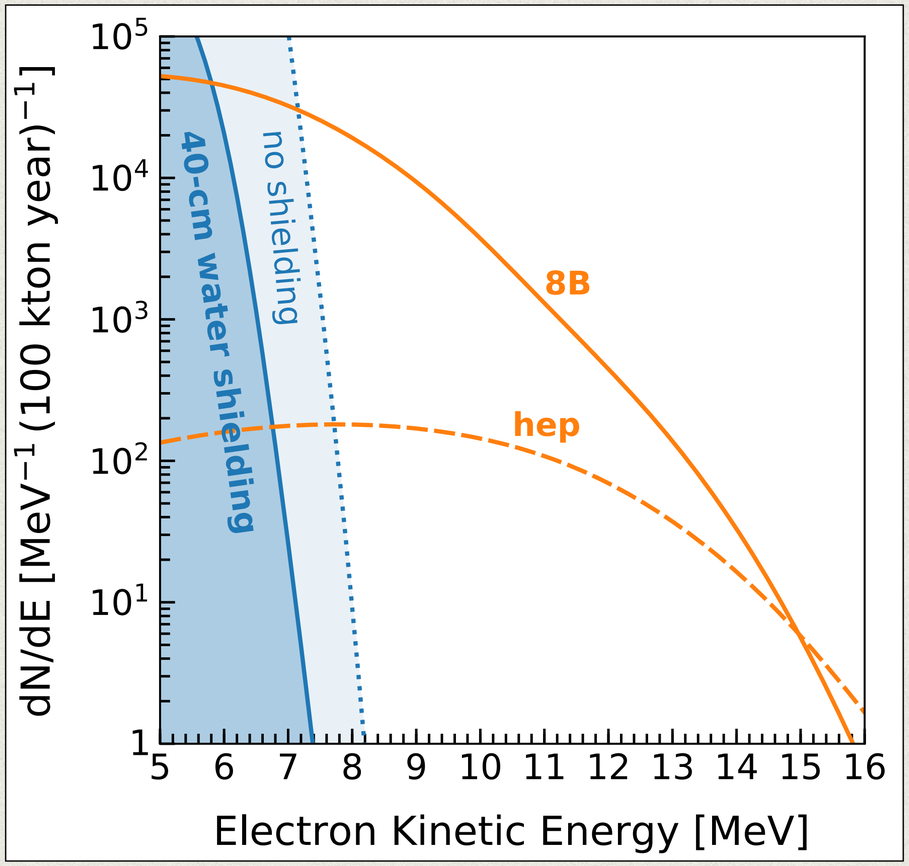
Solar neutrinos vs. backgrounds

Backgrounds: cosmic-ray muons



Zhu et al., in prep

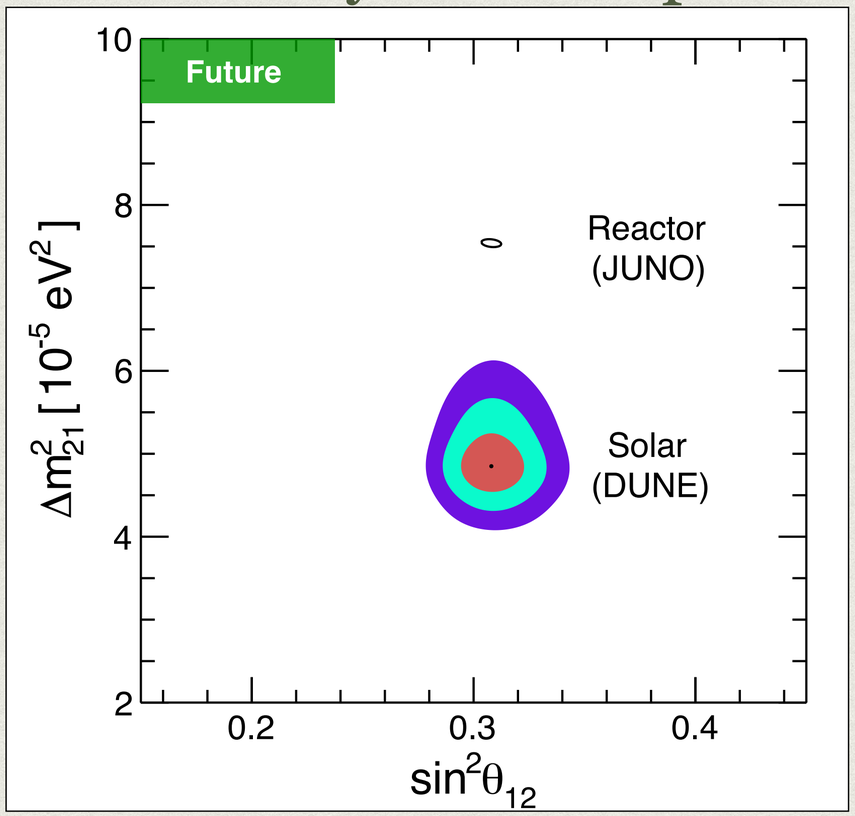
Backgrounds: radioactivity neutrons



Zhu et al., in prep

Conclusions — DUNE is required

DUNE 100-yr-kton exposure



In addition, 8B flux 2.5%, hep 11%

Solar neutrinos

- **Successful past; and exciting future**
- **DUNE would make crucial contributions**
- **We show such potential; significant but realistic new efforts would be required**