Impact of Flux Model Choice on Reactor Experiments

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Introduction

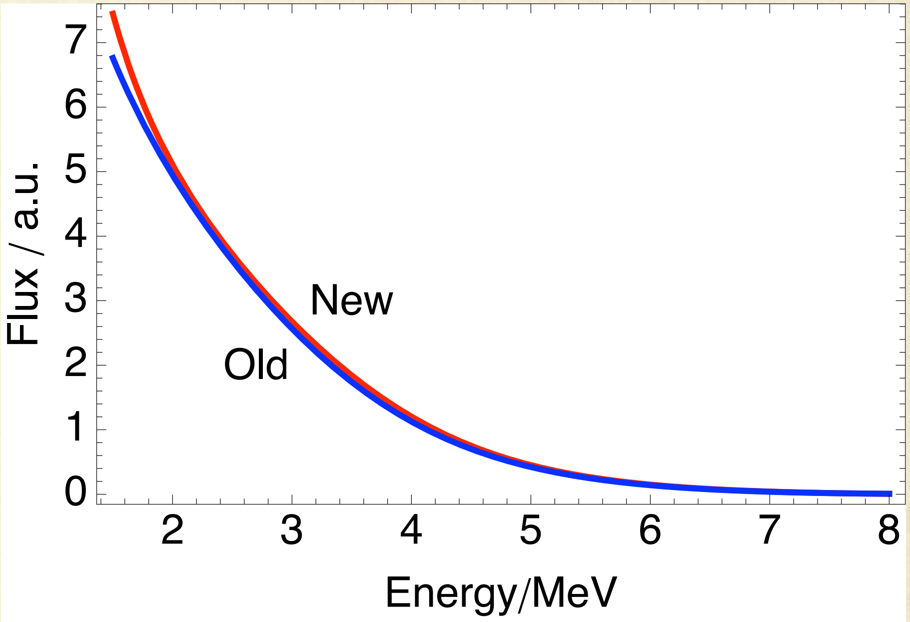
- Reactor experiments use $\overline{\nu}_e$ from β decay of fission fragments
- Look for disappearance:

$$P_{\overline{\nu}_e\overline{\nu}_e} = 1 - sin^2 2\theta sin^2(\frac{\Delta m^2 L}{4E})$$

- Sterile and active disappearance channels use the same expression

Reactor $\overline{\nu}_e$ Fluxes

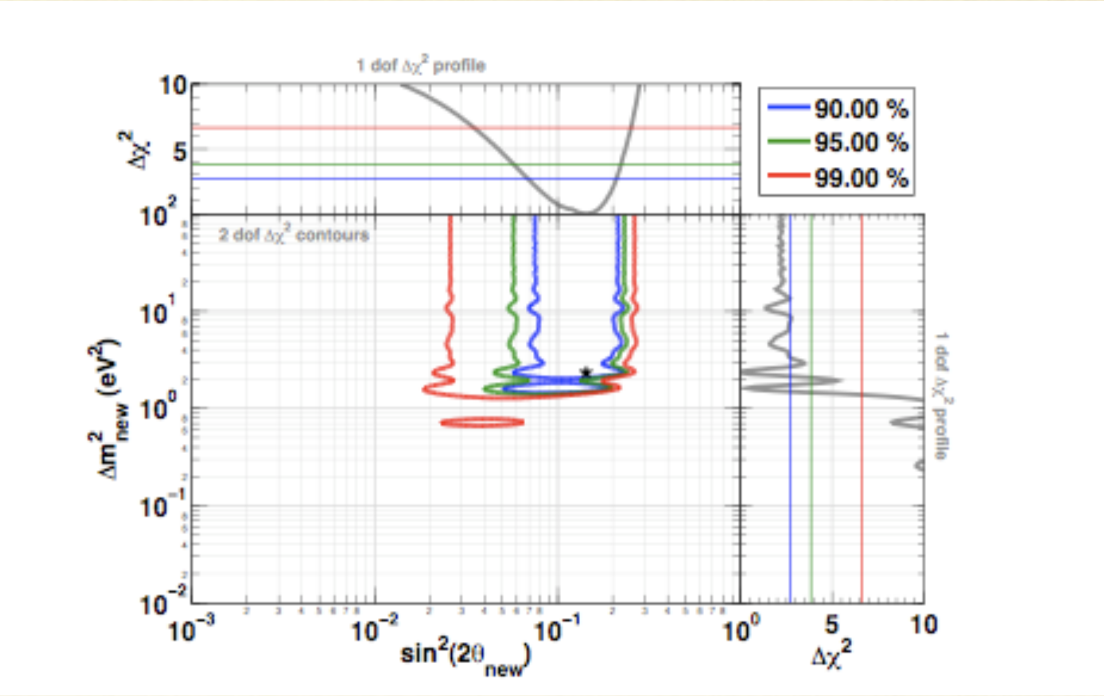
- Get integrated β spectrum
- Do calculations to convert electron spectra to neutrino spectra (Schreckenbach)
- Recent calculation results in an average 3% normalization upward shift



Huber and Schwetz arXiv:hep-ph/0407026
Mueller et al. arXiv:1101.2663

Reactor $\overline{\nu}_e$ Anomaly

- If the flux goes up and old data is used, there is a count deficit
- Possible explanation for deficit in short baseline experiments is oscillation into a sterile neutrino



Mention et al. arxiv:1101.2755

θ_{13} Reactor Experiments

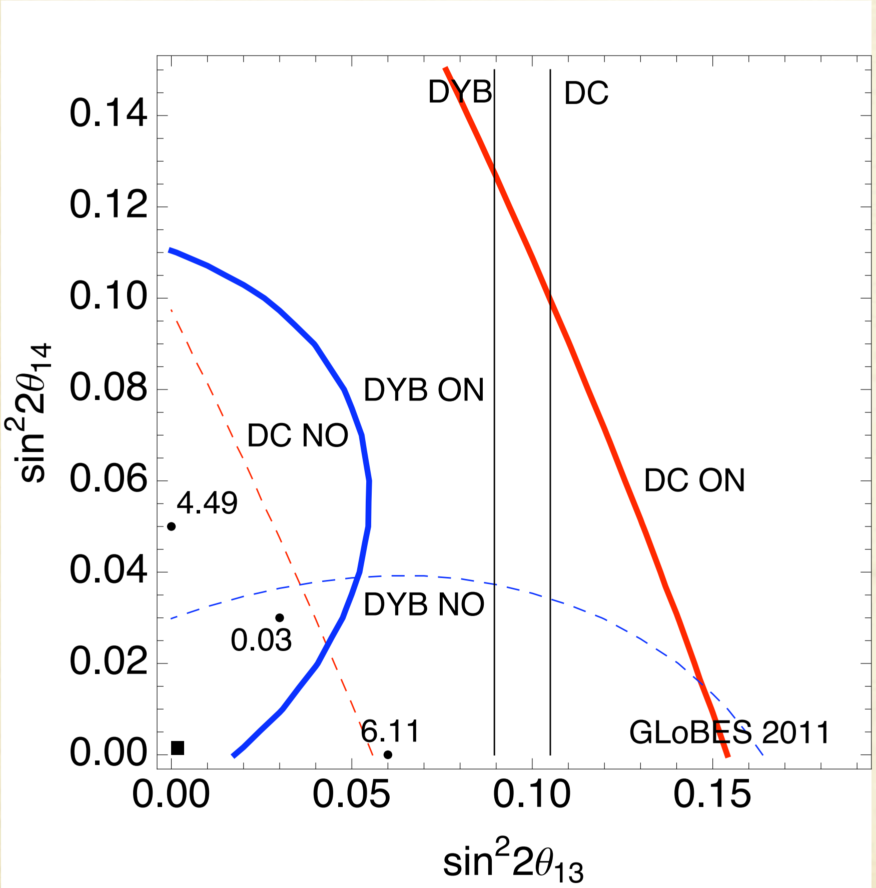
- Use two detector locations to cancel dependence on fluxes
- Initial data from Daya Bay will be from 1 near site
- Initial data from Double Chooz will be from 1 far site
- How should one deal with the new flux?

The Setup

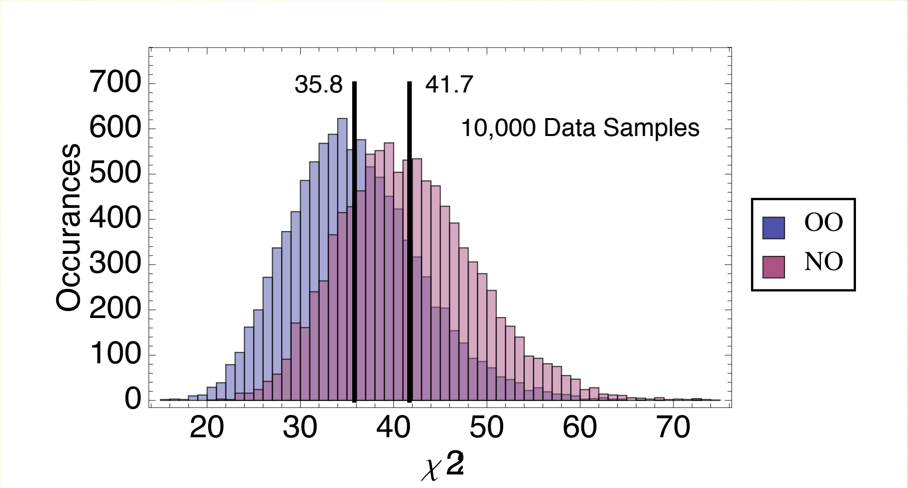
- Use GLoBES to simulate early stages of Daya Bay and Double Chooz
- Choose true data to have no θ_{13} or sterile mixing
- Choose the “true” flux model and fit with the other

GLoBES: hep-ph/0407333, hep-ph/0701187

DYB Near & DC Far

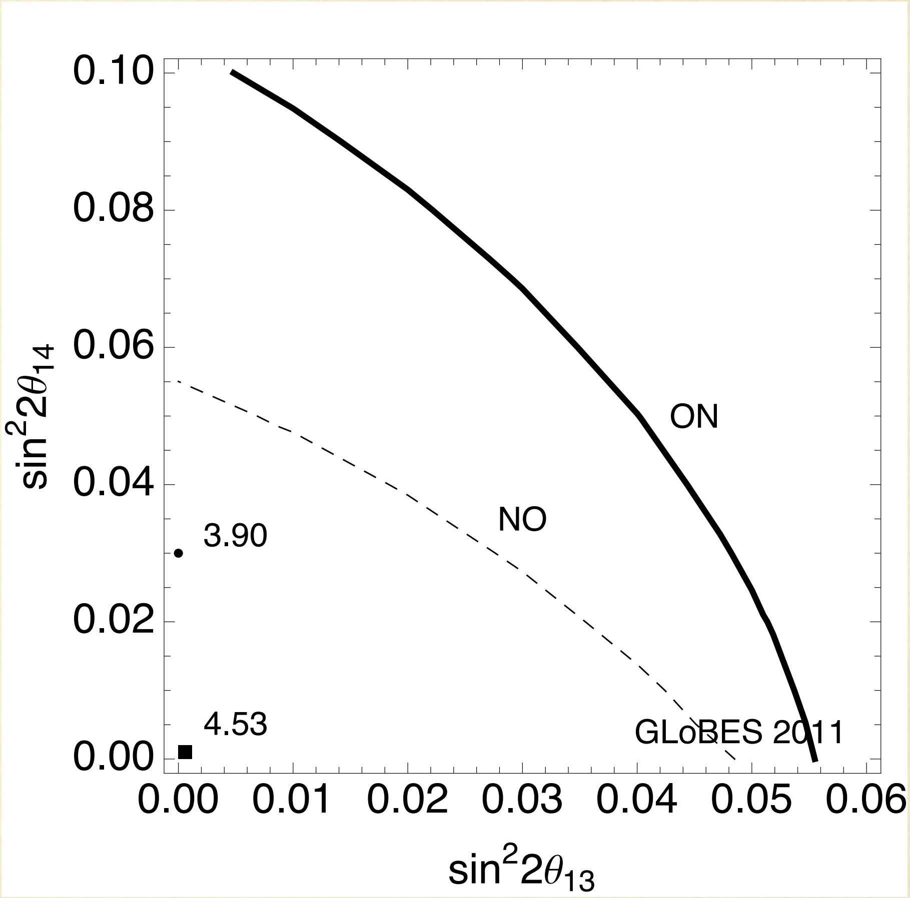


- 3 month run time
- 2% reactor flux error
- ON → Old flux fitted with New
- NO → New flux fitted with Old



Combining Initial Data

- Combine Daya Bay near and Double Chooz far with correlate flux error
- Similar θ_{13} range for both fits



Summary

- Multiple reactor flux models exist
- With only one detector, the choice of model greatly impacts θ_{13} fit
- Combining early stages of Daya Bay and Double Chooz alleviates the problem
- With near and far detectors active at DYB or DC, difference in θ_{13} measurements between fits is small