Neutrino Anomalies & Sterile $\nu$ Hypothesis

Orders of magnitude

Active suppression by $>3$

Short-baseline reactor anomaly ($\nu_e$ disappearance)

Extra neutrino oscillations or artifact of flux predictions?

Understanding reactor flux and spectrum anomalies requires new reactor measurements

High Flux Isotope Reactor, ORNL as a Compact Antineutrino Source

Power: 85 MW (research)

Fuel: highly enriched uranium ($^{235}\text{U}$)

Core shape: cylindrical

Size: $h=0.5\text{m} \; r=0.2\text{m}$ (compact)

Duty-cycle: 41%

HEU core provides static spectrum of mainly $^{235}\text{U}$.

Compact core (<1m) avoids oscillation washout

Background Reduction Via Segmentation

Step 3: Identification of multiple particle interactions

Step 4: Fiducialization

Active suppression by >3 orders of magnitude

PROSPECT Detector and Shielding Development

PROSPECT Detector System

A Segmented, 4L-Loaded Detector

Antineutrino Event Identification using 4L Doped Scintillator

Pulse Shape Discrimination

Backgrounds:
- fast neutron
- n-like prompt, n-like delay
- accidental gamma
- y-like prompt, y-like delay

Background reduction is key challenge

PROSPECT Physics

Precision Oscillation Experiment

4× test of best fit after 1 year
>3× test of favored region after 3 years
5× test of allowed region after 3+3 years

Precision Spectrum Experiment

Measurement of $^{235}\text{U}$ spectrum

Comparison of different reactor models

PROSPECT Publications
arXiv: 1506.03547, 1508.06575, 1512.02202

PROSPECT - A Precision Reactor Neutrino Oscillation and Spectrum Experiment

K.M. Heeger on behalf of the PROSPECT collaboration

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See also: P03.053, P03.054, P03.056

Prospect.yale.edu P3.055