APS DIVISION OF PARTICLES & FIELDS
DPF 2017
MEETING OF THE AMERICAN PHYSICAL SOCIETY DIVISION OF PARTICLES AND FIELDS

Contribution ID: **163** Type: **Presentation**

Improved Search for a Light Sterile Neutrino at Daya Bay, and Combined Analysis with MINOS and Bugey-3

Monday, 31 July 2017 11:21 (18 minutes)

Reactor neutrino experiments are well-suited for probing the existence of a light sterile neutrino in the region of a sub-eV^2 mass splitting (largely unexplored until recently). Using eight functionally identical antineutrino detectors (ADs), the Daya Bay experiment measures the electron antineutrinos produced by six 2.9 GW commercial nuclear reactors located near Shenzhen, China. By combining 404 days of 8-AD data with 217 days of 6-AD data (previously reported), a sample of 1.2 million antineutrino candidates was used to test for oscillations to a sterile fourth neutrino in the mass range of 2×10^{-4}
$lesssim$
$Dm241$
$lesssim 0.3$ eV^2. Joint fits were performed for θ_{13}, θ_{14}, and
$Dm241$, dominated either by the ratio of the two near-hall spectra (for
$Dm241$
$gtrsim 0.01$ eV^2) or the ratio of far to near-hall spectra (for smaller splittings). Independent fits were performed using two techniques, a covariance matrix approach and one using nuisance parameters, and limits were set using the Feldman-Cousins and CL$_s$ methods, respectively. The two methods were mutually consistent within expectation, and found no evidence for a sterile neutrino in the mass range considered. For
$Dm241$
$lesssim$ 0.2 eV^2, 95\% C.L. limits of $\sin^2 2\theta_{14}$
$lesssim 0.01$ were set, forming the most stringent constraints to date in this region.

Going further, sensitivity was extended for 0.2
$lesssim$
$Dm241$
$lesssim 2$ eV^2 by including the results of the Bugey-3 short-baseline reactor experiment in a combined reanalysis. Finally, the addition of MINOS acclerator neutrino data enabled strong constraints to be set on $\sin^2 2\theta_{\mu e} = 4|U_{e4}|^2|U_{\mu 4}|^2$, which governs the strength of the anomalous short-baseline signals claimed by the LSND and MiniBooNE experiments. This three-experiment joint analysis excludes the LSND/MiniBooNE allowed regions for
$Dm241$
$lesssim 1$~eV^2 at 90\% C.L., significantly constraining the allowed parameter space for a four-flavor explanation of the "anomaly."

Primary author: Mr KRAMER, Matt (UC Berkeley)

Presenter: Mr KRAMER, Matt (UC Berkeley)

Session Classification: Neutrino Physics

Track Classification: Neutrino Physics