NuFIT 4.0: Three-neutrino fit based on data available in November 2018

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Abstract: We present updated results for our global analysis of solar, atmospheric, reactor, and accelerator neutrino data in the framework of three-neutrino oscillations. We also provide χ^2 tables for the various one- and two-dimensional projections of the global analysis. If you use these results, please refer to both [1] and [2].

Solar experiments

- *External information*: Standard Solar Model [3].
- Chlorine total rate [4], 1 data point.
- Gallex & GNO total rates [5], 2 data points.
- SAGE total rate [6], 1 data point.
- SK1 full energy and zenith spectrum [7], 44 data points.
- SK2 full energy and day/night spectrum [8], 33 data points.
- SK3 full energy and day/night spectrum [9], 42 data points.
- SK4 2055-day day-night asymmetry [10] and 2860-day energy spectrum [11], 24 data points.
- SNO combined analysis [12], 7 data points.
- Borexino Phase-I 741-day low-energy data [13], 33 data points.
- Borexino Phase-I 246-day high-energy data [14], 6 data points.
- Borexino Phase-II 408-day low-energy data [15], 42 data points.

Atmospheric experiments

- *External information*: Atmospheric neutrino fluxes [16].
- IceCube/DeepCore 3-year data [17, 18], 64 data points.
- SK1-4 328 kiloton years [19], χ^2 map [20] added to our global analysis.

Reactor experiments

- KamLAND separate DS1, DS2, DS3 spectra [21] with Daya Bay reactor ν fluxes [22], 69 data points.
- Double Chooz FD-I/ND and FD-II/ND spectral ratios, with 455-day (FD-I), 363-day (FD-II) and 258-day (ND) exposures [23], 56 data points.
- Daya Bay 1958-day EH2/EH1 and EH3/EH1 spectral ratios [24], 52 data points.
- Reno 2200-day FD/ND spectral ratios [25], 26 data points.

Accelerator experiments

- MINOS 10.71×10^{20} pot ν_μ-disappearance data [26], 39 data points.
- MINOS 3.36×10^{20} pot $\bar{\nu}_\mu$-disappearance data [26], 14 data points.
- MINOS 10.6×10^{20} pot ν_e-appearance data [27], 5 data points.
- MINOS 3.3×10^{20} pot $\bar{\nu}_e$-appearance data [27], 5 data points.
- T2K 14.93×10^{20} pot ν_μ-disappearance data [28], 55 data points.
- T2K 14.93×10^{20} pot ν_e-appearance data [28], 23 data points for the CCQE and 16 data points for the CC1π samples.
- T2K 11.24×10^{20} pot $\bar{\nu}_\mu$-disappearance data [29], 55 data points.
- T2K 11.24×10^{20} pot $\bar{\nu}_e$-appearance data [29], 23 data points.
- NOνA 8.85×10^{20} pot ν_μ-disappearance data [30], 76 data points.
- NOνA 8.85×10^{20} pot ν_e-appearance data [30], 13 data points.
- NOνA 6.91×10^{20} pot $\bar{\nu}_\mu$-disappearance data [30], 76 data points.
- NOνA 6.91×10^{20} pot $\bar{\nu}_e$-appearance data [30], 12 data points.

Description of the χ^2 data tables

We provide four gzip-compressed files, containing the χ^2 data tables for both Normal and Inverted Ordering of our global «w/o SK-atm» and «with SK-atm» analyses. Each file is divided into 21 sections, identified by a unique tag and corresponding to a particular one- or two-dimensional projections. The tags and the meaning of the data columns for each section are listed below (note that $\ell = 1$ for NO and $\ell = 2$ for IO).

N°	Section tag	1st column	2nd column	3rd column
1	`# T13/T12`	$\sin^2\theta_{13}$	$\sin^2\theta_{12}$	$\Delta\chi^2$
2	`# T13/DMS`	$\sin^2\theta_{13}$	$\log_{10}(\Delta m^2_{21} / [\text{eV}^2])$	$\Delta\chi^2$
3	`# T12/DMS`	$\sin^2\theta_{12}$	$\log_{10}(\Delta m^2_{21} / [\text{eV}^2])$	$\Delta\chi^2$
4	`# T13/T23`	$\sin^2\theta_{13}$	$\sin^2\theta_{23}$	$\Delta\chi^2$

N°	Section tag	1st column	2nd column	3rd column
5	`# T13/DMA`	$\sin^2\theta_{13}$	$\Delta m^2_{3\ell}\,/\,[10^{-3}\ \mathrm{eV}^2]$	$\Delta\chi^2$
6	`# T23/DMA`	$\sin^2\theta_{23}$	$\Delta m^2_{3\ell}\,/\,[10^{-3}\ \mathrm{eV}^2]$	$\Delta\chi^2$
7	`# T13/DCP`	$\sin^2\theta_{13}$	$\delta_{\mathrm{CP}}\,/\,[\mathrm{deg}]$	$\Delta\chi^2$
8	`# T23/DCP`	$\sin^2\theta_{23}$	$\delta_{\mathrm{CP}}\,/\,[\mathrm{deg}]$	$\Delta\chi^2$
9	`# DMA/DCP`	$\Delta m^2_{3\ell}\,/\,[10^{-3}\ \mathrm{eV}^2]$	$\delta_{\mathrm{CP}}\,/\,[\mathrm{deg}]$	$\Delta\chi^2$
10	`# T12/T23`	$\sin^2\theta_{12}$	$\sin^2\theta_{23}$	$\Delta\chi^2$
11	`# T12/DCP`	$\sin^2\theta_{12}$	$\delta_{\mathrm{CP}}\,/\,[\mathrm{deg}]$	$\Delta\chi^2$
12	`# T12/DMA`	$\sin^2\theta_{12}$	$\Delta m^2_{3\ell}\,/\,[10^{-3}\ \mathrm{eV}^2]$	$\Delta\chi^2$
13	`# DMS/T23`	$\log_{10}\!\left(\Delta m^2_{21}\,/\,[\mathrm{eV}^2]\right)$	$\sin^2\theta_{23}$	$\Delta\chi^2$
14	`# DMS/DCP`	$\log_{10}\!\left(\Delta m^2_{21}\,/\,[\mathrm{eV}^2]\right)$	$\delta_{\mathrm{CP}}\,/\,[\mathrm{deg}]$	$\Delta\chi^2$
15	`# DMS/DMA`	$\log_{10}\!\left(\Delta m^2_{21}\,/\,[\mathrm{eV}^2]\right)$	$\Delta m^2_{3\ell}\,/\,[10^{-3}\ \mathrm{eV}^2]$	$\Delta\chi^2$
16	`# T13`	$\sin^2\theta_{13}$	$\Delta\chi^2$	—
17	`# T12`	$\sin^2\theta_{12}$	$\Delta\chi^2$	—
18	`# T23`	$\sin^2\theta_{23}$	$\Delta\chi^2$	—
19	`# DCP`	$\delta_{\mathrm{CP}}\,/\,[\mathrm{deg}]$	$\Delta\chi^2$	—
20	`# DMS`	$\log_{10}\!\left(\Delta m^2_{21}\,/\,[\mathrm{eV}^2]\right)$	$\Delta\chi^2$	—
21	`# DMA`	$\Delta m^2_{3\ell}\,/\,[10^{-3}\ \mathrm{eV}^2]$	$\Delta\chi^2$	—

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