Bayesian Fit to NOvA Data Subsamples for Three Flavor Oscillation Analysis

Larry Zhao (University of California Irvine) for the NOvA Collaboration

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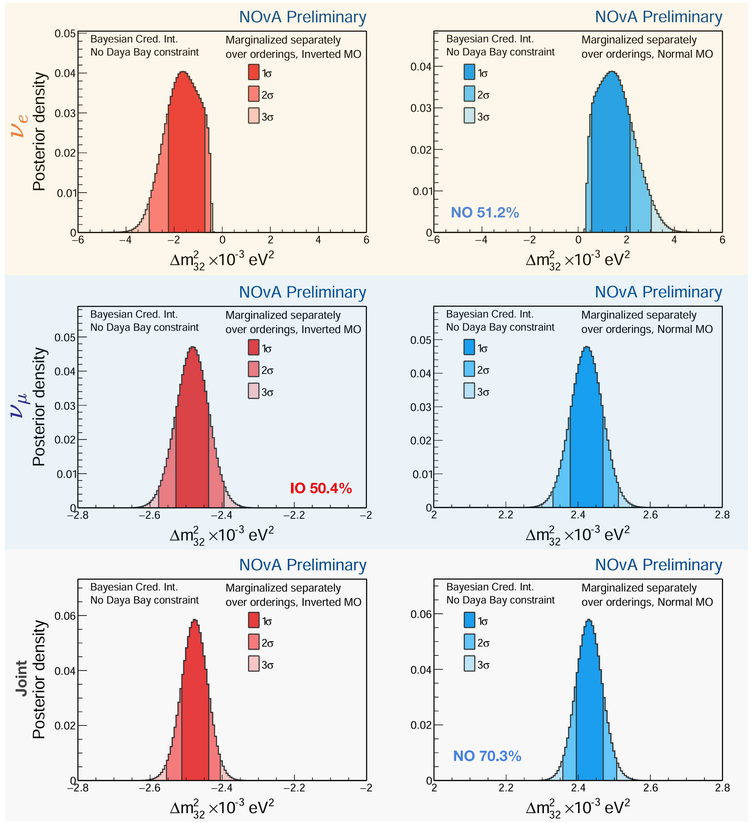
Introduction

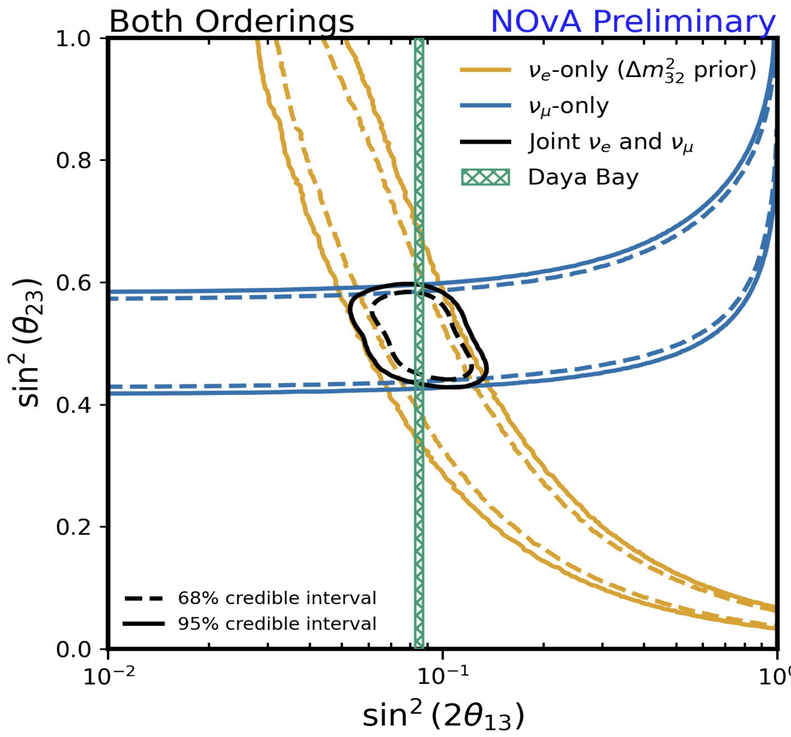
- NOvA is a long-baseline neutrino experiment
- Measure neutrinos from NuMI beam
- Near+Far detectors measure neutrino oscillation
- 10 years of data for precision measurement of oscillation parameters [1]
- Fit ν_e and ν_μ only subsamples to same dataset
  - Understand joint fit dependency on subsamples

Mass Ordering



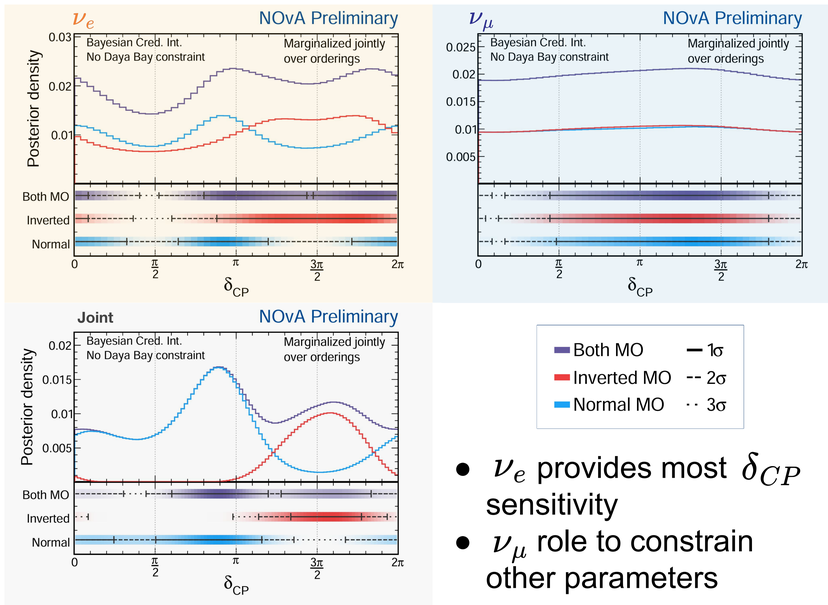
- Δm^2_{32} sensitivity driven by ν_μ data
  - ν_e data Δm^2_{32} posterior distribution is wider than Joint, ν_μ data
- ν_e, ν_μ: no significant MO preference
  - Together: 70.3% normal ordering preference

2D Posterior Density



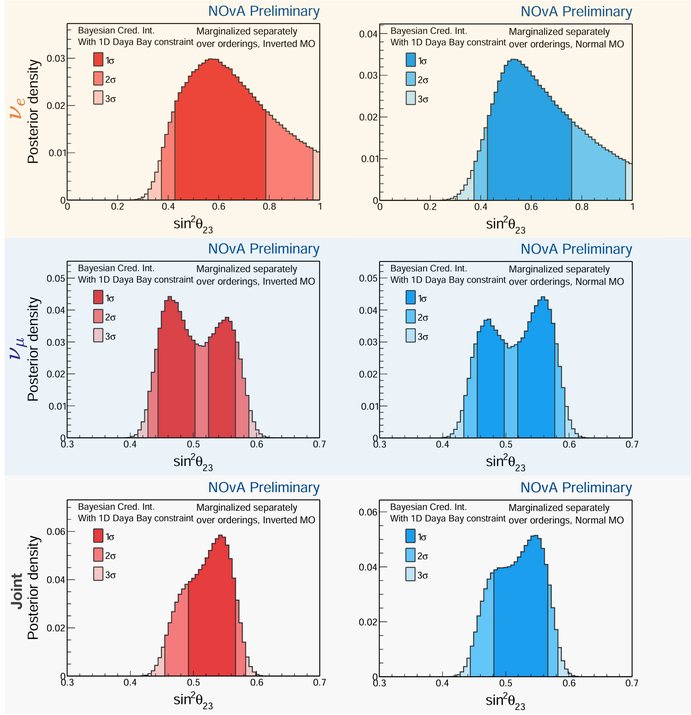
- Joint contour lies at intersection of ν_e, ν_μ contours

CP Violation



- ν_e provides most δ_{CP} sensitivity
- ν_μ role to constrain other parameters

Oscillation Angles



Neutrino Oscillation Angle with Daya Bay θ_{13} Constraint

θ_{23} Upper Octant (UO) vs Lower Octant (LO):

	ν_e	ν_μ	Joint
Inverted MO	79% UO	51% UO	71% UO
Normal MO	78% UO	61% UO	67% UO

Conclusions

- ν_μ constraints improve Δm^2_{32}, δ_{CP} sensitivity
- Δm^2_{32} prior reduces ν_e parameter space in 2D oscillation plot
- ν_e, ν_μ data consistent with other experiments in 2D oscillation space

References:

[1] S. Abubakar et al. "Precision measurement of neutrino oscillation parameters with 10 years of data from the NOvA experiment." In: Physical Review Letters 136.1 (Jan. 2026). ISSN: 1079-7114. DOI: 10.1103/x53y-2b86.

[2] A. Sztuc et al. NuMCMCTools/NuMCMCTools: v1.1.0. Version v1.1.0. Oct. 2025. DOI: 10.5281/zenodo.17342363

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