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# The near term race for the Neutrino Mass Ordering

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We revisit a method for determining the neutrino mass ordering by using precision measurements of the atmospheric $\Delta m^2$'s in both electron neutrino and muon neutrino disappearance channels, proposed by the authors in 2005~\cite{Nunokawa:2005nx}. The mass ordering is a very important outstanding question for our understanding of the elusive neutrino and determination of the mass ordering has consequences for other neutrino experiments. The JUNO reactor experiment will start data taking this year, and the precision of the atmospheric $\Delta m^2$'s from electron anti-neutrino measurements will improve by a factor of three from Daya Bay's 2.4\% to 0.8\% within a year. This measurement, when combined with the atmospheric $\Delta m^2$'s measurements from T2K and NOvA for muon neutrino disappearance, will contribute substantially to the $\Delta \chi^2$ between the two remaining neutrino mass orderings. In this paper we derive a mass ordering sum rule that can be used to address the possibility that JUNO's atmospheric $\Delta m^2$'s measurement, when combined with other experiments in particular T2K and NOvA, can determine the neutrino mass ordering at the 3 $\sigma$ confidence level within one year of operation. For a confidence level of 5 $\sigma$ in a single experiment we will have to wait until the middle of the next decade when the DUNE experiment is operating.

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## Working Group

WG 1: Neutrino Oscillation Physics

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