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Shedding light on the Δm^2_{21} tension with supernova neutrinos

One long-standing tension in the determination of neutrino parameters is the mismatched value of the solar mass square difference, Δm^2_{21}, measured by different experiments: the reactor antineutrino experiment KamLAND finds a best fit larger than the one obtained with solar neutrino data. Even if the current tension is mild ($\sim 1.5\sigma$), it is timely to explore if independent measurements could help in either closing or reassessing this issue. In this regard, we explore how a future supernova burst in our galaxy could be used to determine Δm^2_{21} at the future Hyper-Kamiokande detector, and how this could contribute to the current situation. We study Earth matter effects for different models of supernova neutrino spectra and supernova orientations. We find that, if supernova neutrino data prefers the KamLAND best fit for Δm^2_{21}, an uncertainty similar to the current KamLAND one could be achieved. On the contrary, if it prefers the solar neutrino data best fit, the current tension with KamLAND results could grow to a significance larger than 5σ. Furthermore, supernova neutrinos could significantly contribute to reducing the uncertainty on $\sin^2\theta_{12}$.

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yes

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