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MSW effects on the time evolution of the supernova neutrino event rates

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The flavour transition mechanisms of supernova neutrinos as they propagate outward from the deep inside of the supernova are yet to be determined. We study the time-evolution patterns of different neutrino flavours in various flavour transition scenarios. With simulation data of supernova neutrinos, we calculate the neutrino event rates at different kinds of detectors for different flavour transition scenarios. Using the calculated event rates of electron neutrinos in liquid argon detectors, event rates of electron anti-neutrinos (IBD) and proton elastic scatterings in liquid scintillation detectors, we calculate two ratios by dividing the first two flavour dependent event rates by the flavour blind proton elastic scatterings event rates for the entire duration of the supernova explosion. We find that in different flavour transition scenarios, the time evolution of these ratios exhibits different patterns, which can be clearly distinguished from one another.

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