

Effects of nonzero Majorana CP phases on oscillations of supernova neutrinos

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We study the effects of nonzero Dirac and Majorana CP-violating phases in neutrino oscillations in a magnetic field of astrophysical environments. It is shown that in the presence of strong magnetic fields and dense matter, nonzero CP phases can induce new resonances, particularly in the oscillations channels $\nu_e \leftrightarrow \bar{\nu}_e$, $\nu_e \leftrightarrow \bar{\nu}_\mu$ and $\nu_e \leftrightarrow \bar{\nu}_\tau$. We show that neutrino-antineutrino oscillations can affect the $\bar{\nu}_e/\nu_e$ ratio for neutrinos coming from the supernovae explosion, provided that the Majorana CP-violation phases are nonzero. The detection of supernovae neutrino fluxes in the future experiments, such as JUNO, DUNE and Hyper-Kamiokande, can give an insight into the nature of CP violation and, consequently, provides a tool for distinguishing the Dirac or Majorana nature of neutrinos.

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References

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