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CP Violation at a Neutrino Factory

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Exciting prospects for the discovery of CP violation in the neutrino sector have recently been made more likely by the measurement of the neutrino mixing angle θ_{13} . CP violation is a necessary condition for leptogenesis to be at the origin of the matter-antimatter asymmetry of the universe. A number of future options for establishing CP violation in neutrinos are possible, but the Neutrino Factory, in which beams of neutrinos are created from the decays of muons in a storage ring, offers the best sensitivity for this discovery and the most precise measurements of the mixing parameters and CP phase in the leptonic sector, which is related to the problem of flavour, the existence of three generations in nature and leptogenesis.

The International Design Study for the Neutrino Factory (the IDS-NF) was established to deliver a Reference Design Report (RDR). The baseline design has been revised in the light of the new θ_{13} results. The facility will provide 10^{21} muon decays per year from 10 GeV stored muon beams pointing at a large (100 kton) Magnetised Iron Neutrino Detector (MIND) at a distance between 2000–2500 km. A description of the facility and a new upgraded neutrino oscillation analysis will be used to determine the CP sensitivities and the measurement of the CP phase δ . A compelling case for a Neutrino Factory will be made, based on the unprecedented precision in δ and the prospects of new physics in the neutrino sector that such a Neutrino Factory will be able to establish.

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