Physics at a future Neutrino Factory and super-beam facility

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Abstract

The conclusions of the Physics Working Group of the International Scoping Study of a future Neutrino Factory and super-beam facility (the ISS) are presented. The ISS was carried out by the international community between NuFact05, (the 7th International Workshop on Neutrino Factories and Super-beams, Laboratori Nazionali di Frascati, Rome, 21–26 June 2005) and NuFact06 (Ivine, CA, 24–30 August 2006). The physics case for an extensive experimental programme to understand the properties of the neutrino is presented and the role of high-precision measurements of neutrino oscillations within this programme is discussed in detail. The performance of second-generation super-beam experiments, beta-beam facilities and the Neutrino Factory are evaluated and a quantitative comparison of the discovery potential of the three classes of facility is presented. High-precision studies of the properties of the muon are complementary to the study of neutrino oscillations. The Neutrino Factory has the potential to provide extremely intense muon beams and the physics potential of such beams is discussed in the final section of the report.