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## Neutrino Super Beam for lepton CP violation discovery based on the European Spallation Source

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For the lepton CP violation discovery very intense neutrino beams are needed produced using very powerful proton beams. The proposed project, ESSnuSB, is based on the European Spallation Source proton linac the construction of which started in 2014 and will finish by 2023. This linac will have a power of 5 MW producing protons of 2 GeV energy. The combination of the high beam intensity and the comparatively low proton energy allows the neutrino measurements to be made with a megaton Water Cherenkov neutrino detector installed 1000 m down in a mine at ~540 km from the neutrino source which is near the position of the second neutrino oscillation maximum. The relative variation of the electron neutrino yield with the CP violation angle  $\delta_{CP}$  is about three times larger at the second maximum as compared to that at the first maximum. This implies that the measurement of  $\delta_{CP}$  is about three times less sensitive to the experimental systematic errors, which is the error determining the ultimate performance for discovery and measurement of leptonic CP violation. This observation has the potential to shed light on the matter-antimatter asymmetry in Universe. The performance of the experiment for such measurements will be presented and compared with other proposed experiments. The use of the large underground neutrino detector to measure the proton lifetime, detect cosmological neutrinos and neutrinos from supernova will also be described.

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