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P3.018 **The ESS neutrino facility for CP violation discovery**

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The comparatively large value of the neutrino mixing angle θ_{13} measured in 2012 by neutrino reactor experiments has opened the possibility to observe for the first time CP violation in the leptonic sector. The measured value of θ_{13} also privileges the 2nd oscillation maximum for the discovery of CP violation instead of the usually used 1st oscillation maximum. The sensitivity at the 2nd oscillation maximum is about three times higher than at the 1st oscillation maximum implying a significantly lower sensitivity to systematic errors. Measuring at the 2nd oscillation maximum necessitates a very intense neutrino beam with the appropriate energy. The world's most intense pulsed spallation neutron source, the European Spallation Source, has a proton linac with 5 MW power and 2 GeV energy. This linac also has the potential to become the proton driver of the world's most intense neutrino beam with very high potential for the discovery of neutrino CP violation. The physics performance of that neutrino Super Beam in conjunction with a megaton Water Cherenkov neutrino detector installed ca 1000 m down in a mine at a distance of about 500 km from ESS has been evaluated. In addition, the use of such a detector will make it possible to extent the physics program to proton–decay, atmospheric neutrinos and astrophysics searches. The ESS proton linac upgrade, the accumulator ring needed for proton pulse compression, the target station optimization and the physics potential are described. In addition to the production of neutrinos, this facility will also be a copious source of muons which could be used to feed a low energy nuSTORM facility, a future neutrino factory or a muon collider. The ESS linac, under construction, will reach full operation at 5 MW by 2023 after which the upgrades for the neutrino facility could start.

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