

# The ESSnuSB project

Wednesday, July 29, 2020 4:15 PM (15 minutes)

Considering the relatively large value of the last measured neutrino mixing angle  $\theta_{13}$ , the way is now open to observe for the first time a possible CP violation in the leptonic sector. The measured value of  $\theta_{13}$  also privileges the 2nd oscillation maximum for the discovery of CP violation instead of the usually used 1st oscillation maximum. The sensitivity at this 2nd oscillation maximum is significantly higher than for the 1st oscillation maximum inducing a lower influence of systematic errors. Going to 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, will have a proton linac with the unprecedented power of 5 MW and 2 GeV energy. This linac, under construction, also has the potential to become the proton driver of the world's most intense neutrino beam with very high potential to discover and well measure a neutrino CP violation. The physics performance of that neutrino Super Beam in conjunction with a megaton underground Water Cherenkov neutrino detector installed at a distance of about 500 km from ESS has been evaluated. In addition, the choice of such detector will extent the physics program to proton-decay, atmospheric neutrinos and astrophysics searches. The ESS proton linac upgrades, the accumulator ring needed for proton pulse compression, the target station optimization and the physics potential are described. In addition to neutrinos, this facility will also produce at the same time a copious number of muons which could be used by a low energy nuSTORM facility, a Neutrino Factory or/and a muon collider. The ESS neutron facility will be fully ready by 2025 at which moment the upgrades for the neutrino facility could start.

This project is supported by the COST Action CA15139 "Combining forces for a novel European facility for neutrino-antineutrino symmetry-violation discovery" (EuroNuNet). It has also received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 777419.

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## Secondary track (number)

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**Session Classification:** Neutrino Physics

**Track Classification:** 02. Neutrino Physics