

The HighNESS Project and Neutron Oscillation Searches at the European Spallation Source

Luca Zanini

European Spallation Source
on behalf of the nnbar Collaboration

The European Spallation Source (ESS), presently under construction in Lund, Sweden, is a multi-disciplinary international laboratory that will operate the world's most powerful pulsed neutron source. Supported by 3 MEuro Research and Innovation Action within the EU Horizon 2020 program, a design study (HighNESS) is now underway for a second neutron source which will be complementary to the first source, and deliver longer wavelength neutrons and higher cold neutron intensities. Proposed experiments include a search for neutron conversions to antineutrons (NNBAR) and measurements with ultra cold neutrons.

This talk focuses on the HighNESS program and other fundamental physics possibilities at the ESS with an emphasis on NNBAR. The NNBAR experiment is a two-step program, starting with the HIBEAM stage which would make high precision searches for free neutrons converting to sterile neutrons and thus probing a possible dark sector whilst also performing R&D for the second stage of the experiment, the NNBAR stage, which would fully exploit the high intensity delivered by the new neutron source designed within HighNESS. This new source, together with other unique features of the NNBAR experiment, such as the 200-m long beamline, the optimized reflector system, and the dedicated detector, will allow an improvement in sensitivity, compared with the last such search, to neutrons converting to antineutrons by three orders of magnitude.