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The HIBEAM/NNBAR Experiments

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The violation of baryon number is an essential ingredient for baryogenesis - the preferential creation of matter over antimatter - needed to account for the observed baryon asymmetry in the Universe. However, such a process has yet to be experimentally observed.

The HIBEAM/NNBAR program is a proposed two-stage experiment at the European Spallation Source to search for baryon number violation. The program will include high-sensitivity searches for processes that violate baryon number by one or two units: free neutron-antineutron oscillation via mixing, neutron-antineutron oscillation via regeneration from a sterile neutron state and neutron disappearance; the effective process of neutron regeneration is also possible. The program can be used to discover and characterize mixing in the neutron, antineutron and sterile neutron sectors. The experiment addresses topical open questions such as the origins of baryogenesis and the nature of dark matter, and is sensitive to scales of new physics substantially in excess of those available at colliders. A goal of the program is to open a discovery window to neutron conversion probabilities (sensitivities) by up to three orders of magnitude compared with previous searches, which is a rare opportunity. A conceptual design report, funded by European Union and national funding agency grants, has recently been prepared and is available.

Summary

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