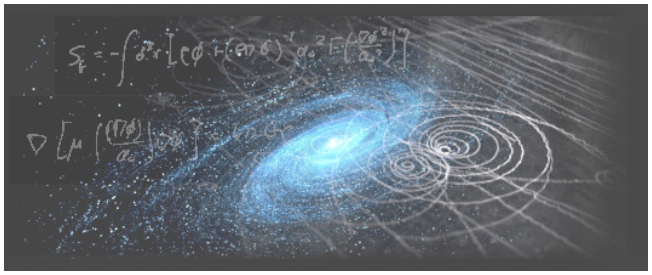

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Fundamental Particle Physics at ESS

Tuesday, 22 October 2024 16:15 (15 minutes)

Presently under construction in Lund, Sweden, the European Spallation Source (ESS) will be the world's brightest neutron source. As such, it has the potential for a particle physics program with a unique reach, complementing those available at other facilities. In this talk, I will provide a general overview of the proposed particle physics activities for the ESS, which encompass the exploitation of both the neutrons and neutrinos produced at the ESS for high precision measurements and searches. In particular I will focus on the projects led by Swedish researchers, The HIBEAM/NNBAR and the ESSnuSB projects.
The HIBEAM/NNBAR initiative will explore baryon number violation (BNV) by searching for neutron oscillations, a breakthrough that could challenge the Standard Model of particle physics. The first phase, HIBEAM, will focus on investigating neutron-antineutron oscillations, sterile neutrons from a potential 'dark sector' of particles, and axion-like particle searches. The second phase, NNBAR, aims to improve sensitivity to neutron-antineutron oscillations by three orders of magnitude compared to previous experiments, making it the most precise test of BNV to date.
The ESSnuSB project will investigate leptonic CP violation, a key factor in explaining the dominance of matter over antimatter in the universe. By leveraging the ESS's high-power linear accelerator, ESSnuSB will measure the CP phase angle δ_{CP} with unprecedented precision, significantly advancing the study of leptogenesis models. The project will also provide unique opportunities to detect neutrinos from supernovae and search for proton decay, crucial for testing theories of baryon-number non-conservation.
Together, these projects will position the ESS at the forefront of both neutron science and particle physics, enabling groundbreaking discoveries in the understanding of the universe's fundamental forces.
A Consortium for Fundamental Particle Physics at ESS has been created earlier this year with the aim to stimulate and coordinate this program of research.

Summary

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