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Neutrino Theory in the Precision Era

This document summarises discussions on future directions in theoretical neutrino physics, which are the outcome of a neutrino theory workshop held at CERN in February 2025. The starting point is the realisation that neutrino physics offers unique opportunities to address some of the most fundamental questions in physics. This motivates a vigorous experimental programme which the theory community fully supports. A strong effort in theoretical neutrino physics is paramount to optimally take advantage of upcoming neutrino experiments and to explore the synergies with other areas of particle, astroparticle, and nuclear physics, as well as cosmology. Progress on the theory side has the potential to significantly boost the physics reach of experiments, as well as go well beyond their original scope. Strong collaboration between theory and experiment is essential in the precision era. To foster such collaboration, we propose to establish a CERN Neutrino Physics Centre. Taking inspiration from the highly successful LHC Physics Center at Fermilab, the CERN Neutrino Physics Centre would be the European hub of the neutrino community, covering experimental and theoretical activities.

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