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Precision measurement of neutrino oscillations with Hyper-Kamiokande

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Ever since the first measurements were made of these ghostly particles, neutrinos have been a constant fascination for physicists due to their unusual properties. One such peculiarity is that neutrinos can seemingly change flavours as they propagate —a phenomenon known as neutrino oscillation. The oscillation probabilities are determined by a set of fundamental parameters in the Standard Model. Decades of neutrino experiments designed to probe these parameters have narrowed down much of the phase space, yet many unanswered questions remain: Is there CP-violation in the lepton sector? Which neutrino is the lightest? Are there neutrinos beyond the three generations? The answers to these questions may hold the key to discovering physics beyond the Standard Model and understanding our universe, but answering them requires detectors much more powerful than those currently in operation. The successor of the T2K and Super-Kamiokande experiments, Hyper-Kamiokande, is a next generation experiment with a 260 kiloton water Cherenkov far detector, a more powerful neutrino beam and more capable near detectors. It has a broad and ambitious physics program which includes probing the last unknown neutrino oscillation parameters and the precision measurement of neutrino mixing. In this talk, I will begin with a brief introduction of neutrino oscillations and the history of discoveries. I will then describe the Hyper-Kamiokande experiment, its current progress and its physics potentials, and the challenges that must be overcome in order to realize them.

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