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Heavy neutrino searches at the FCC

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The Future Circular Collider (FCC) is proposed as a post-LHC particle collider at CERN and consists of different steps. The first step of the FCC (FCC-ee) is a high-luminosity, high-precision lepton collider located in the same tunnel as a possible precursor to a hadron collider, and complementary to it. The ultimate goal, FCC-hh, is a 100 TeV hadron collider, colliding protons and heavy-ions, with a center of mass energy seven times that of the LHC, an energy step similar to the one from the Tevatron to the LHC. A hadron-lepton collider (FCC-eh), operating with the FCC-hh, could be the finest microscope for studying quark-gluon interactions and possible further substructure of matter.

One of the most interesting searches that will be possible at the FCC concerns heavy neutrinos, or heavy neutral leptons. These hypothetical new particles hold an incredible potential, since they could provide answers to many interesting open questions in the standard model (SM) of particle physics, from neutrino masses to the matter-antimatter imbalance of the Universe, including offering a plausible Dark Matter candidate.

At the FCC (ee, hh, eh) a large parameter space will be within reach for Heavy Neutrinos. The FCC-ee running at the Z-Pole will be unbeatable: heavy neutrino produced in Z decays with low-mixing with the regular neutrinos, all the way to the domain of type-1 seesaw models, could give rise to characteristic, and essentially background free, long-lived signatures in the detectors. When the decay lengths of these new particles is long enough, neutrino oscillations might even be studied, and offer limited sensitivity for tests of Lepton Number Violation. The initial state flavor and charge is known at FCC-hh and FCC-eh, and therefore they will offer tests of lepton-flavor violation and Lepton Number violation in a domain of somewhat larger mixing angles.

This is the right time to start benchmarking the most interesting physics process to study at the different phases of the FCC, exploring the corresponding detector requirements; during this process heavy neutrinos will take a central stage. The complementarity of the three different stages of the FCC provides unique potential to discover and pin down these particles, and maybe solving long-standing problems of the SM. This talk will describe the current landscape and possible areas to contribute to in the next years.

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