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An experiment to search for hidden particles at the SPS

The recent discovery of the Higgs boson with mass ~125.5 GeV implies that the Standard Model (SM) may well be a self-consistent, weakly-coupled, effective field theory all the way up to the Planck scale. Nevertheless, it is clear that the SM is incomplete since it does not provide an explanation for the observations of non-zero neutrino masses, the excess of matter over antimatter in the Universe, and the presence of non-baryonic dark matter. These shortcomings may have their origin in new physics involving very weakly interacting particles such as predicted by models of portals to a hidden sector with heavy Majorana leptons, dark photons etc, or in SUSY. Given the small coupling constants and typically long lifetimes, these new different particles have not been significantly constrained by previous experiments, and the reach at current collider experiments is limited by both luminosity and acceptance. This talk will outline a proposal of a general-purpose fixed target facility at the SPS to search for hidden particles. The large production of charm mesons with the 400 GeV beam and the high intensity of the SPS allow accessing a wide variety of light long-lived exotic particles. As a starting point for the study of the sensitivity, the neutrino Minimal Standard Model (vMSM) has been used. The vMSM can account simultaneously for neutrino masses and oscillations, baryogenesis, and dark matter. With an integrated total of 2×10^{20} protons on target, the experiment is able to achieve a sensitivity which is four orders of magnitude better than previous searches, accessing a significant fraction of the unexplored parameter space which is consistent with cosmological constraints. Dark photons which appear in a large class of dark matter models may be explored through the production in photonic meson decays and in bremsstrahlung from the incoming proton beam. Such a facility would clearly be an essential complement to the LHC and the other fixed target programs in the search for new physics.