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Search for GeV-scale sterile neutrinos responsible for active neutrino masses and baryon asymmetry of the Universe

We propose a new beam-target experiment, which may lead to the discovery of new particles below the Fermi scale - right-handed partners of neutrinos. We provide a strong motivation for existence of such particles: three new neutral Majorana particles (sterile neutrinos) are associated with simultaneous solution of the problems of neutrino masses and oscillations, of baryon asymmetry of the Universe and of Dark Matter. We concentrate on the heavier pair of sterile neutrinos, responsible for the matter-antimatter asymmetry generation and for the active neutrino masses. If lighter than 2 GeV, these particles can be produced in charmed meson decays and subsequently decay into light SM particles.

The “golden signature” of such particles is two tracks of charged particles coming from one vertex. The searches of Majorana leptons were undertaken in the past at PS191, BEBC, CHARM, NuTeV and led to a negative result, not surprising in view of the cosmological constraints on the properties of sterile neutrinos, that were derived later on. To fully explore this sector with 400 GeV beam and 10^{20} incident protons on target (achievable at CERN SPS in the future) one needs a detector constructed from sections, each of the size and structure similar to previous detectors but with a total length of few kilometers. A smaller detector with a length of ~100 meters would allow for an exploration of considerable fraction of parameter space.

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