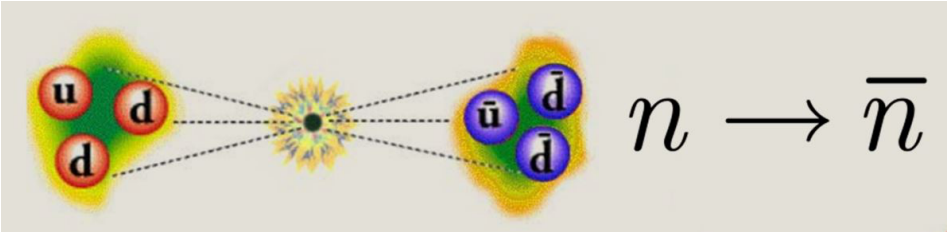

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Search for neutron oscillations to a sterile state ($n \to n^{'}$) and to an antineutron ($n \to \overline{n}$)

Wednesday, 5 August 2020 12:30 (30 minutes)

As follows from theoretical conjectures of Z. Berezhiani et al. [2006-2020] the neutron that is part of the Standard Model (SM) can oscillate into sterile state $n \to n^{'}$, thus leading to neutron disappearance or baryon number violation $\Delta B = -1$. However, this can be only an apparent disappearance: if the sterile neutron $n^{'}$ is part of the Mirror Standard Model ($SM^{'}$) with corresponding mirror baryon number $B^{'}$ the transformation $n \to n^{'}$ can occur without violation of the global baryon number $\Delta\left(B + B^{'}\right) = 0$. This process will be not necessarily suppressed by high mass scale and can have observable probability corresponding to oscillation times as small as 1-100 s. The $SM^{'}$ sector is assumed to be an exact copy of SM with the same particle content and the same gauge interactions within $SM^{'}$, but these interactions are absent between SM and $SM^{'}$ particles, e.g. mirror photon $\gamma^{'}$ will not interact with SM charges and vice versa. The gravity however is a common interaction for both sectors thus making $SM^{'}$ a good candidate for the Dark Matter. Also, additional new BSM interactions are conjectured that mix the neutral particles of SM and $SM^{'}$ sectors (like γ, ν, n and possibly other neutral particles) that makes such interactions responsible for the direct detection of DM and for transformations like $\gamma \to \gamma^{'}$, $\nu \to \nu^{'}$, and particularly interesting $n \to n^{'}$, as a most convenient for experimental observation process.
Existing neutron sources provide cold neutron beams with high intensities that can be used for rather simple and inexpensive experimental searches like $n \to n^{'}$ disappearance, $n \to n^{'} \to n$ regeneration, searches for neutron transition magnetic moment, and neutron – antineutron transformations through mirror-state oscillations $n \to n^{'} \to \overline{n}$. Plans for such measurements with existing neutron sources at the Oak Ridge National Laboratory and at the future European Spallation Source and the sensitivity reach will be discussed in the workshop presentation.

Contribution Title

Search for neutron oscillations to the sterile state $n \to n^{'}$ and to antineutron $n \to \overline{n}$

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