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Neutron lifetime measuring experiments with UCN magnetic storage

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Precision measurements of the neutron lifetime provide stringent tests of the standard electroweak model [1] as well as crucial inputs for Big-Bang nucleosynthesis calculations [2]. When combined with measurements of other neutron beta decay correlation coefficients [1], the neutron lifetime enables the determination of the Vud element of the Cabbibo-Kobayashi-Maskawa quark mixing matrix, providing a complementary unitarity test to that obtained from superallowed nuclear beta decay [3]. The neutron lifetime is also one of the key parameters for the determination of yields of light elements in BBN since the ratio between the free neutron and proton abundances drives the extent of fusion reactions during the first few minutes of the Universe [2].
Magnetic trapping of ultracold neutrons (UCN) permits to control neutron losses during neutron lifetime measuring. To realize this advantage of UCN magnetic storage is possible only using of magnetic shutter. Without this unique opportunity, experiments with magnetic storage are indistinguishable from experiments with storage in material traps. Systematics in neutron lifetime measuring experiments using UCN magnetic storage is discussed.
Measurement of the neutron lifetime using ultracold neutrons stored in a magneto-gravitational trap made of permanent magnets is discussed. Neutrons surviving in the trap after fixed storage times have been counted and the trap losses have continuously been monitored during storage by detecting neutrons leaking from the trap. The value of the neutron lifetime resulting from this measurement is τn = (878.3 +- 1.6stat +- 1.0syst) s [4]. A unique feature of this experiment is the monitoring of leaking neutrons providing a robust control of the main systematic loss.
Main features of a new magnetic trap with enlarged volume are discussed.

1 D. Dubbers and M.G. Schmidt, Rev. Mod. Phys. 83, 1111, (2011).

2 D.N. Schramm and M.S. Turner, Rev. Mod. Phys. 70, 303 (1998).

3 I.S. Towner and J.C. Hardy, Rep. Prog. Phys. 73, 046301, (2010).

4 V.F. Ezhov et. al., JETP Letters,.107(11), p 671–675,(2018).

Authors: Mr EZHOV, Victor (1Petersburg Nuclear Physics Institute NRS KI, Gatchina, Russia); Mr RYABOV, Vladimir (1Petersburg Nuclear Physics Institute NRS KI, Gatchina, Russia)

Presenter: Mr EZHOV, Victor (1Petersburg Nuclear Physics Institute NRS KI, Gatchina, Russia)

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