DNP10-2010-000324

Abstract for an Invited Paper
for the DNP10 Meeting of
the American Physical Society

Neutron Lifetime[1]

ANATOLII SEREBROV, PNPI, Petersburg Nuclear Physics Institute, Russian Academy of Sciences, RU-188300 Gatchina, Leningrad District, Russia

The recent neutron lifetime experiment [1] has provided the value 878.5 ± 0.8 s. It differs by 6.5 standard deviations from the world average value 885.7 ± 0.8 s quoted by the particle data group (PDG) in 2006 [2]. In determination of the world average value of the neutron lifetime there is rather dramatic situation. On the one hand a new value of neutron lifetime from work [1] cannot be included in the world average value because of the big difference of results. On the other hand until this major disagreement is understood the present world average value for the neutron lifetime must be suspect. So the situation on PDG page devoted to the neutron lifetime is formulated [2] in view of this controversy. The only way out of the present situation is to carry out new more precise experiments. More detailed analysis of the previous experiments and search of possible systematic error is also reasonable. In this connection the analysis and Monte Carlo simulation of experiments [3] and [4] is carried out. Systematic errors of about -6 s are found in each of the experiments. The summary table for the neutron lifetime measurements after corrections and additions is given. A new world average value for the neutron lifetime 879.9 ± 0.9 s is presented. The value $|V_{ud}| = 09743(7)$, calculated for the new world average value for the neutron lifetime 879.9(9) s and $g_A = 12750(9)$ [5], agrees with both $|V_{ud}| = 097419(22)$ from the unitarity of the CKM matrix elements [2] and $|V_{ud}| = 097425(22)$, measured from the superallowed $0^+ \rightarrow 0^+$ nuclear β-decays, caused by pure Fermi transitions only [5,6]. The analysis of neutron β-decay with new world average neutron lifetime demonstrates reasonable agreement in frame of Standard Model.

[1] A. Serebrov et al., Phys. Lett. B 605, 72 (2005); A.P. Serebrov et al., Phys. Rev. C 78, 035505 (2008).
[2] C. Amsler et al. (Particle Data Group), Phys. Lett. B 667, 1 (2008).
[3] S. Arzumanov et al., Phys. Lett. B 483, 15 (2000).
[4] W. Mampe et al., Phys. Rev. Lett. 63, 593 (1989).
[5] H. Abele, Prog. Part. Nucl. Phys. 60, 1 (2008).
[6] J. C. Hardy, I.S. Towner, Phys. Rev. C 79, 055502 (2009).

[1]This visit is supported by LANL.