

Big Gravitational Trap for neutron lifetime measurements

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Improvement of accuracy of neutron lifetime measurements is of great importance for physics of elementary particles and cosmology. At present the best accuracy of measurements is reached in PNPI experiment with a gravitational trap of ultracold neutrons (UCN) [Phys. Lett. B 605, 72 (2005)]. Now at PNPI a new installation with a big UCN gravitational trap is made. The planned accuracy of measurements 0.2 s is 4 times better than present level of accuracy. The specified accuracy will be reached because of considerable improvement of statistical accuracy of measurements due to increase in volume of UCN trap and decrease in UCN transport losses. The systematic is planned to be reduced due to improvement of working vacuum and use of insert that allows to carry out UCN storage measurements with an increased frequency of collisions without an installation disassembling.

The Monte-Carlo model of experiment is made. In it there is a possibility to set concrete value of neutron lifetime, then to repeat experimental procedure and to see whether there is a difference between the set and measured value. As a result of simulation the systematic uncertainty connected with a method of calculation of effective frequency of UCN collisions in the trap is defined. It has made 0.1 s. Also simulation of various constructive elements of setup is made.

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