STATUS OF EXPERIMENTAL SEARCH FOR ELECTRIC DIPOLE MOMENT OF NEUTRON

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An experimental search for the electric dipole moment of the neutron has a long history and up-to-now remains an urgent problem of the investigations of the violation of parity and time invariance. The evolution of the experimental and theoretical investigations of the neutron EDM for last decades is presented in the figure.

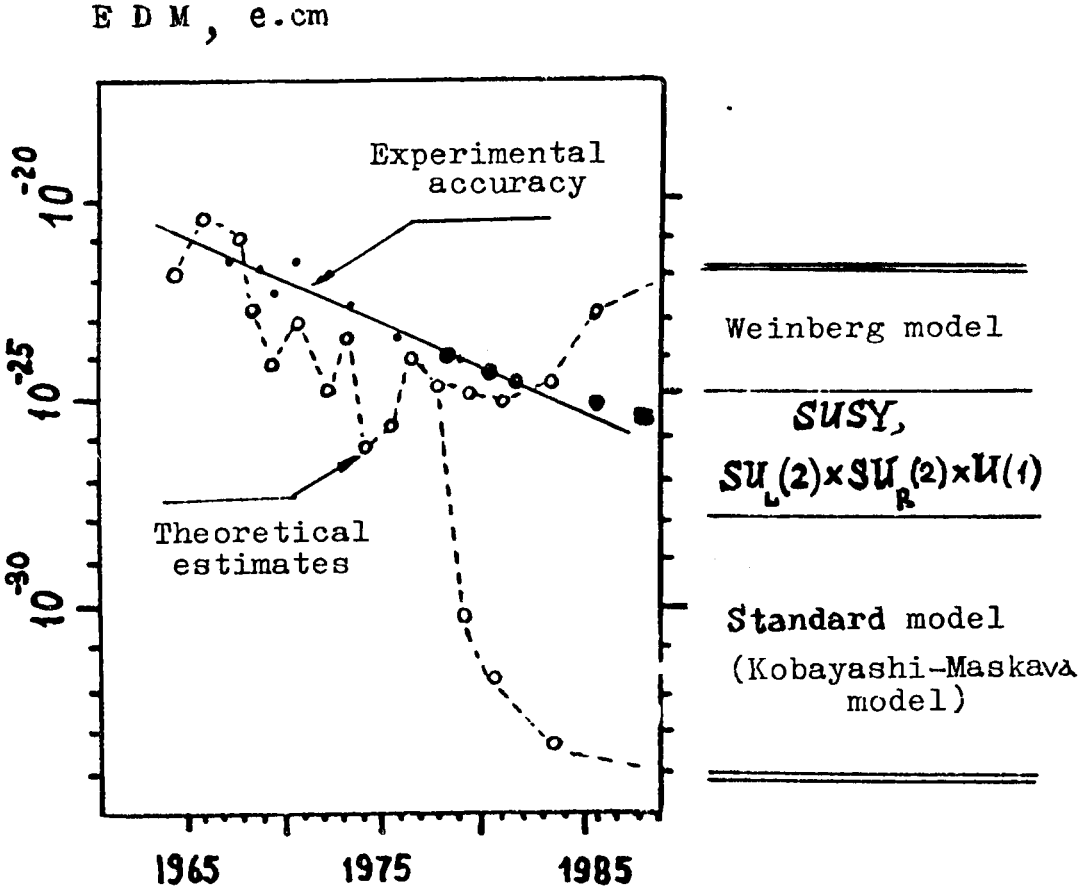

Fig.

The measurements of the neutron EDM are carried out with the use of the magnetic resonance method at the ultracold neutrons beam [1]. The magnetic resonance spectrometer with the electric field, constructed at the LNPI, uses ultracold neutrons from a liquid hydrogen source placed at the centre of the reactor core. The prolonged ($\sim$100 sec) containment of the UCN is used in the spectrometer.

The magnetic resonance width is about 5 mHz, the electric field strength is about $\sim$10 — — 15 kV/cm.

In first run the storage-type spectrometer provided the result for the neutron EDM [2] $d_n = -(1.1 \pm 0.7)\cdot 10^{-25}$ e. cm, that set a limit on the EDM $d_n < 2.6\cdot 10^{-25}$ e. cm at the 95% confidence level.

A further modernization of the set-up was undertaken to improve polarization of the neutrons, the magnetic resonance stabilization and to increase the neutron counting.

As in the earlier measurements we use the differential method of the measurement, using two neutron confinement chambers with oppositely directed electric fields and with common static magnetic and rf fields. A system for simultaneous detecting of ultracold neutrons polarized in opposite directions was used.

The run was carried out with modernized spectrometer. Unfortunately, during the last run we have not succeded completely to save from the effect of the switching of high voltage on the counting systems.

Combining of the data for four detectors has made it possible to cancel the systematic errors, but taking into account the possibility of the incomplete cancellation of the systematic errors, the preliminary result of the measurements can be submitted as a limit $d_n < 1.5 \cdot 10^{-25}$ e. cm. The next run and the data treatment give us possibility to have more reliable and more precise result.

The result of the neutron EDM measurement obtained by the ILL group with the storage type one-chamber spectrometer was published [3] $d_{\overline{n}} = (-3 \pm 5) \cdot 10^{-26}$ e. cm and set the limit $d_n < 1.3 \cdot 10^{-25}$ e. cm at the 90% confidence level.

The achieved experimental accuracy, apparently, makes it possible to verify the EDM estimations in the left-right symmetric models.

REFERENCES

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