**VERIFICATION OF T INVARIANCE IN THE TOTAL INTERACTION CROSS SECTION**

**OF NEUTRONS WITH UNPOLARIZED NUCLEI USING THE POLARIZATION–ASYMMETRY THEOREM**

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To date, the violation of T invariance (TI) has been experimentally established for the decays and oscillations of neutral kaons. Phenomenologically, TI violation in the system of neutral kaons is associated with the difference of the Kobayashi–Maskawa phase from zero (or from π) in the standard model of the electroweak interaction. For nucleon–nucleus interactions, this phase turns out to be very small. Estimates of the nucleon–nucleon matrix element corresponding to TI violation in various models are small and have a large spread. Therefore, the verification of TI in nuclear processes actually means a search for other mechanisms for its violation. The talk describes the experimental methods for TI verification in the total interaction cross sections of low-energy resonance neutrons with unpolarized nuclei with the use of the polarization–asymmetry (PA) theorem.

The theorem declares (R. Dalitz 1952): if TI takes place, then for an unpolarized incident beam of particles with spin 1/2 the polarization *P* of scattered particles is equal to the asymmetry *A* in the scattering of a completely polarized beam.

The talk shows that PA takes place in total cross section (transmission) of the neutrons through an unpolarized nuclear target in a presence of strong and weak P - odd interactions. A weak interaction causes an appearance of polarization in the initially unpolarized neutron beam and a dichroism of the total cross sections for polarized beam. The experiment has two stages. In a first - a polarized neutron beam passes through a target and an asymmetry of the transmissions *A* for the opposite neutron polarizations is measured. In a second - a polarization *P*, which arises in initially unpolarized beam after its transmission through a target is detected. Both stages use the same device (spin filter) as a neutron polarizer and analyzer of neutron polarization. It is shown in accordance with PA that in a case of TI, *А* = *Р* ~ *vP*, where *vP* is a real (within a common agreement) matrix element of P - odd interaction.

Further, it is shown that if *vP* → *vP* +*ivT* and imaginary part changes its sign under time reversal, PA theorem declares *А* ≠ *Р*. In this case *vT* is a matrix element of interaction, which violates TI.

Further a two level approximation, which describes the experimental P - odd effects in neutron - nuclear interactions is used. This approximation explicitly depends on *vP* quantity. A substitution *vP* → *vP* +*ivT* leads to an explicit dependence of *A* and *P* on *vT*:

 

where *p* - analyzing power of spin filter, *nt* - number density of a target with thickness *d*. The parts of total cross section σ*P* and σ*Т* ~ *vT* correspond to violation of parity and TI, respectively. The talk presents the result of calculation of the effect  for p - wave resonance 0.734 eV in 139La, where a largest P-odd effect was observed. The talk considered a case of TI violation, but parity conserving as well.

Further, the beam intensity estimation was done to get one standard deviation accuracy within a realistic time of measurement. Besides, an analysis of the systematic errors and the ways of their minimizations was provided. It is shown that the false effects of the proposed method can be overcome to a much greater extent than errors in the methods with polarized and aligned targets, which are much more complicated from a technical point of view.