

Measurement of the spin rotation parameters A and R is a key experiment in the whole program of studying π^+p elastic scattering since only such measurement permits to remove discrete ambiguities arising in the course of a phase shift analysis. This experiment is carried out at the pion channel of ITEP accelerator by PNPI scientists and engineers in collaboration with physicists of Institute for Theoretical and Experimental Physics (Moscow). The experiment has required the development of a special type of polarized proton target with the polarization vector lying in the horizontal plane and a proton polarimeter for measuring the asymmetry of the secondary scattering of the recoil protons by nuclei of a substance (usually carbon) with the known analyzing power. The polarized proton target, placed between a pair of superconducting Helmholtz coils, was built at PNPI by physicists of the Meson Physics Laboratory and the Laboratory of Polarization Effects. As to the proton polarimeter, two types were used at different stages of the experiment. One was a multiplate polarimeter made of optical spark chambers with graphite electrodes; a special television system was developed for filmless read-out in this case. Another type of polarimeter consists of one thick graphite block (36.5g/cm^2) with two arrays of magnetostrictive spark chambers (in front and behind of this block) to detect the recoil proton before and after the secondary scattering; the analyzing power of this polarimeter was determined experimentally using the beam of polarized protons available at ITEP.

The spin rotation parameters A , R for π^-p and π^+p elastic scattering were measured at ITEP at three energies of the incident pions: 870 MeV (corresponding value of the incident pions momentum is 1000 MeV/c), 1297 MeV (1430 MeV/c) and 1486 MeV (1620 MeV/c). One of the most interesting results is the fact that experimentally measured values of the parameter A agree well with the predictions of the partial-wave analysis performed by a group of physicists from the George Washington University (GWU) and contradict to the analyses KH and CMU-LBL. Since all the characteristics of πN resonances presented in Listings of the Review of Particle Physics are obtained just on the base of the analyses KH and CMU-LBL, which seem to be not entirely correct in the light of our last experimental data, it is necessary to revise and specify these fundamental constants by means of performing a new partial-wave analysis.

Now the new stage of experiments is underway at the ITEP pion channel, namely – measurements of the polarization parameter P for π^+p scattering to the backward hemisphere. Already measured are values of the polarization parameter P at the incident pions momenta of 800, 1780, 1940 and 2070 MeV/c in the angular range from 150° to 170° in the centre-of-mass system. Till now no such measurements were made because the extremely low values of differential cross sections. The predictions of the latest solution SP-06 of the GWU group seems to be consistent with our measurements in the low-momentum domain, while at the momenta around 2000 MeV/c the behavior of these predictions looks unstable.