Measurement of analyzing powers for nucleon-nucleus scattering at momentum range from 1.75 to 5.4 GeV/c

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Abstract

At the accelerator complex of the Laboratory on beams of polarized protons and neutrons, measurements of analyzing powers in nucleon-nuclear interactions were carried out with the participation of scientists from Bulgaria, Slovakia, Russia, Great Britain, France and the USA.

At the first stage, experimental data were obtained on the energy dependence of the analyzing power in proton-polyethylene scattering in the momentum range from 1.75 to 5.3 GeV/c, it was shown that the analyzing power decreases with increasing momentum, and the effective angular acceptance of the polarimeter was determined. Based on the obtained data, an experiment at the Jefferson Laboratory (USA) was approved to measure the ratio of the electromagnetic form factors of protons. During these measurements, data were obtained on the analyzing power at proton momenta in the range from 2.0 to 5.4 GeV/c, which confirmed the results obtained in Dubna.

At the second stage, the polarimeter was modernized, *a hadron calorimeter was added to it for the first time in the world*, and measurements were carried out on beams of polarized neutrons. For the first time*, the charge exchange process n + A-> p + X was used as an analyzing reaction for neutron polarimetry*. As a result of the measurements, the nA scattering spectra were obtained, in which the presence of two exponential slopes was found. It is shown that, in the case of nA (Cu) scattering, the calorimeter significantly (approximately twofold) increases the value of the analyzing power. The calorimeter can be independently used to measure the polarization of nucleons, and this possibility can be useful when studying p + A → n + X reactions, when standard track instruments do not register the neutron trajectory. And as in the first case, the Jefferson Laboratory (USA) approved an experiment to measure the ratio of the electromagnetic form factors of neutrons.