THRESHOLD PHENOMENA IN NUCLEAR REACTIONS

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For more than half a century threshold phenomena in nuclear reactions have been drawing attention of researchers by its unique capability for a detailed study of nuclei structure near the energy threshold of opening of any reaction channel, since here occurs an abrupt change of energy dependence of physical quantities characterizing a compound system, caused by its radical internal reconstruction. A flow of probability conservation causes a unitarity of collision matrix, what together with a requirement for reaction amplitude analyticity, conditioned by a causality principle, is a basis for the formal apparatus of threshold phenomena theory (TPT). Specific features of behavior of differential and total cross-sections of reaction channels and elastic scattering near a threshold of one of the channels were predicted by E.Wigner in the year 1948 [1]. In a decade (in the year 1957) G. Breit [2] and A. Baz [3] there was built a consistent TPT theory, which was generalized on the basis of Feshbach microscopic theory [4] by L.M. Lasarev [5] in case of multi-particle reactions and resonances in the compound nucleus near the threshold.

The report represents a review of experimental data on threshold anomalies in a few nucleon systems. As an illustration of wealth of spectroscopy information, obtained when studying threshold anomalies, the system ^{7}Li+t near the threshold ^{7}Li(t,n)^{9}Be*(E_x=14.4 MeV, T=$^{3}/_{2}$) is considered. Analysis of excitation functions of ^{7}Li+t reaction channels has allowed obtaining of energy of the lowest levels with isospin T=2 of nuclei ^{10}Be, determination of their spins and parities, as well as quantum characteristics of nucleon-unstable nucleus ^{10}Li, its mass and energy of the first excited level [6].

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