Contribution ID: **365** Type: **Oral report**

DETERMINATION OF ASYMPTOTIC NORMALIZATION COEFFICIENTS BY ANALYTIC CONTINUATION OF DIFFERENTIAL CROSS SECTIONS

Thursday 23 September 2021 17:20 (25 minutes)

Asymptotic normalization coefficients (ANC) are fundamental nuclear characteristics important both in nuclear reaction and nuclear structure physics. The role of ANCs is especially substantial in determining the cross sections for astrophysical nuclear reactions inaccessible for direct measurement due to the large Coulomb barrier [1]. ANCs are on-shell observables, as distinct from the spectroscopic factors which are off-shell quantities and cannot be reliably extracted from experimental data.

In the present work, we discuss the possibility of determining ANCs by analytic continuation of the differential cross sections of transfer reactions to the pole point in the scattering angle θ lying in the unphysical region $\cos\theta > 1$. Special attention is paid to the corrections to the pole contribution to the differential cross section due to the Coulomb interaction in the initial and final states of the reaction (see [2] and references therein). The role is discussed of kinematic singularities arising in the case of nonzero orbital angular momenta at the vertices of the pole diagram, which determines the transfer mechanism. The discussed method was applied to the reaction $^{12}\mathrm{C}(d,p)^{13}\mathrm{C}^*\left(1/2^+; 3.09\mathrm{MeV}\right)$. Five experimental differential cross sections corresponding to the deuteron energy in the range of $5-30\mathrm{MeV}$ were used to determine the important ANC C for the vertex $^{13}\mathrm{C}^* \to {}^{12}\mathrm{C}+n$ by analytic continuation. The C values obtained from the analysis of the (d,p) reaction at different energies turned out to be close to each other. The average value of the squared ANC obtained by the method of analytic continuation with account of the Coulomb corrections is $C^2 = 3.52\mathrm{fm}^{-1}$.

This work was supported by the Russian Foundation for Basic Research grant No. 19-02-00014.

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Primary authors: SAVIN, D.A. (Lomonosov Moscow State University); BLOKHINTSEV, L.D. (Lomonosov Moscow State University)

Presenter: BLOKHINTSEV, L.D. (Lomonosov Moscow State University)

Session Classification: Section 1. Experimental and theoretical studies of the properties of atomic nuclei

Track Classification: Section 2. Experimental and theoretical studies of nuclear reactions.