SPECTROSCOPY BY CONTINUATION OF POLARIZATION OBSERVABLES INTO THE NONPHYSICAL REGION

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ABSTRACT: The analycity properties in the cosϑ plane, particulary the kinematical singularities and the strength of the second order transfer pole, are studied. Practical aspects of the continuation procedure are also discussed.

In case of (d,p) reactions the empirical continuation of the differential cross section to the transfer pole in the $z=\cos\vartheta$ variable proved to be useful in extracting spectroscopic information [1] . The polarizations contain more detailed structure information. Before applying the continuation procedure one has (i) to study the singularity structure. The invariant amplitude representation of Bilenky et al. [2] makes it possible to show that at $z=\pm 1$ the unnormalized t_{kq} polarizations have kinematical singularities of the type $(1-z)^{q/2}$ in addition to the usual singularities present in the cross section. (ii) to study the selection rules determining which polarization has second order pole. The first order pole arising from the interference of the amplitude pole with the background can not be used directly to extract structure information. Using the kinematically correct pole amplitudes of Dolinsky et al. [3] one can obtain a lengthy explicit expression for the strength of the second order pole, which gives a set of triangle inequalities. In case of (p,d) reactions, for instance, the vector polarization (k=1) of the deuteron has no second order pole, it is present only for the tenzor polarization (k=2) . The strength of the k=2 pole is, naturally, defined by quite a different combination of the vertex constans as for the cross section. Comparing the two strengths one can separate the $\ell=0$ and $\ell=2$ vertex constants of the deuteron, while no extra information is given on the structure of the target nucleus. The situation is quite similar for the (t,d) reaction.

Keeping in mind the success of the continuation method for the d(d,p)t reaction /the strength of the cross section pole was extracted with an error of 1.5 % [1,4] /, one can propose to analyse the deuteron tenzor analysing power T_{2q} in the d(d,p)t reaction. At forward angles it is dominated by (d,p), while at backward angles by (d,t) neutron transfer process. Therefore one can study the structure of the deuteron and triton at the same time. The d state probability of the deuteron is uncertain to some extent, while very few is known about the triton.

The applicability condition of the continuation method remains the same as for the cross section [4]. It is necessary that the fitted extrapolating polynomial should have a degree of at least 2kR+2. It is better to measure q=0 polarizations or analysing powers, as they have a finite limit at $\vartheta=0^{o}$ and they can be measured with smaller relative error at forward angles. The success of the continuation depends on the experimental errors and on the contribution of the pole singularity. Having some experimental data one can construct a model for the background contribution and study the possibilities of the method.

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