ENERGY POSITION OF MAXIMA IN RESPONSE FUNCTIONS OF ^{2}H NUCLEUS WITH $q = 1 - 1{,}5$ fm^{-1}

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The problem of measuring a quasielastic electron scattering peak energy on nuclei is discussed.
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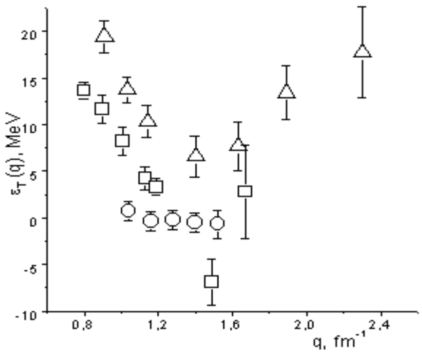
The energy of a peak maximum in quasielastic electron scattering (QES) on nuclear nucleons is designated as ε and is measured from the energy of elastic electron scattering on the nucleon with the same transfer 3-momenta q, that corresponds to a maximum of this peak. The theoretical works [1,2] and some others show that the calculation of $\varepsilon(q)$ depends on the choice of a nucleon potential type. Some of calculated ε(q) functions have a minimum for $q < 1.5$ fm^{-1}, where some minimum in data of ε measurements on the ^{12}C nucleus [3] is observed too. But the result interpretation of such data in the aspect of [1,2] is faced with two difficulties:

I. Originally the experimental ε were defined from dependencies of twice differential cross sections $d^2\sigma$ on the transfer energy ω (values ε obtained by this way we designate as ε_σ). This cross section is a sum of longitudinal R_L and transverse R_T response functions:

$$d^2\sigma \cong \sigma_M(G(q))^2\{R_L(q,\omega)+[0.5+tg(\theta/2)]R_T(q,\omega)\},$$

where σ_M is the Mott cross section, $G(q)$ is the proton electric form factor, θ is the angle of electron scattering. It was showed (e.g., see [2]) that ε_L , corresponding to the R_L-function and $\varepsilon_T - R_T$-function, are unequal. So, according to the equation for $d^2\sigma$, the value ε_σ is in the interval $\varepsilon_L - \varepsilon_T$ and the result of the ε_σ measurement depends on the choice of the angle θ.



II. With the reducing q the QES peak is displaced on ω into the area of excitation of nuclear bound states (NBS), such as giant resonances, and then the experimental ε correspond to the sum peak maximum of nuclear electrodisintegration but it is not a peak of QES described by theoretical calculations.

The experiment has shown that really $\varepsilon_L \neq \varepsilon_T$ [4], and the dependence of ε_T on q at $q \leq 1.3$ fm^{-1} is completely described by the calculation in which the function ε(q) is specified by NBS excitation [5,6]. Analysis of these results in view of the giant resonance systematic leads to the conclusion, that for small transfer momentum the measurement of ε_L and ε_T, which characterize QES, is rather difficult. The ^{2}H nucleus is interesting because it has no excitation states and thus there is a possibility to study ε of QES at small q experimentally.

In the present paper we use the results of measurement of the R_L- and R_T-functions of the ^{2}H nucleus at the linac LUE-300 KIPT and obtain the ε values for $q = 1 - 1.5$ fm^{-1}. We have determined for the ^{2}H nucleus $\varepsilon_L - \varepsilon_T \approx 1$ MeV. The obtained ε_T values are shown in the figure by circles. Also, for comparison, on the figure the ε_T-data from [5] and [6] for ^{6}Li (triangles) and ^{4}He (squares) respectively are quoted. One can see that at $q < 1.5$ fm^{-1} for ε of the ^{2}H nucleus there is no the dependence on q, that is character for ε of other nuclei. This difference in the behavior of dependences of ε on q is a confirmation of NBS role in shaping the maximum peak of nuclear electrodisintegation.

So obtained experimental ε of the ^{2}H nucleus allow extending an area of the calculations checking of a peak QES energy position at q less than 1.5 fm^{-1}.

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REFERENCES

1. R. Rosenfelder. On the shift of the quasielastic peak in inelastic electron scattering // *Phys. Lett.* 1978, v. 79B, p. 15-18.
2. A.Yu. Korchin, A.V. Shebeco. Quasifree peak parameters and sum rules for electron scattering on ^{4}He // *Z. Phys*. 1981, v. A299, p. 131-137.
3. A.Yu. Buki et al. Investigation quasielastic electron scattering on ^{12}C nucleus // *Ukr. Fiz. Zhurn*. 1983, v. 28, p. 1654-1657 (in Russian).
4. A.Yu. Buki et al. Quasielastic elektron scattering on ^{4}He, ^{12}C nuclei and twobody interechion of nucleons // *Yad. Fiz*. 1984, v. 39, p. 1323-1325 (in Russian).
5. A.Yu. Buki et al. Energy peak in electron quasielastic scattering on ^{6}Li // *Yad. Fiz*. 1988, v. 48. p. 913-916 (in Russian).
6. A.Yu. Buki et al. Energy position of the ^{4}He electrodisintegration maximum for small transfer momenta // *Ukr. Fiz. Zhurn*. 1995, v. 40, p. 913-915 (in Ukr.).