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4.6. The three-nucleon bound state wave function from elastic electron scattering

N. BIJEDIĆ, *Institute »Boris Kidrič«, Beograd*

The theoretical investigation of the three-nucleon bound state wave function had a considerable success in the last few years. Nevertheless, the number of independent experimental data is less than the number of parameters we need to define the theoretical problem.

The cross section of the elastic electron scattering (defined as a product of Mott scattering cross section and the form factor of the nucleus) on ^{4}He and ^{3}He nuclei shows a diffraction minimum[1,2] in the region of squared momentum transfer $q^2 \sim 11(\mathrm{fm})^{-2}$.

These data are explained as the efect of the repulsive core in the two nucleon interaction to the three and four nucleon bound state wave function [3,4,5]. In the case of the three-nucleon bound state wave function situation somewhat complicates

TABLE

$q^2(\mathrm{fm})^{-2}$	$F_s(q^2)$	$F_{s-s}'(q^2)$
0	1.0000	0.0000
1	0.6497	—0.2029
2	0.4228	—0.2500
3	0.2768	—0.2351
4	0.1810	—0.1997
5	0.1175	—0.1611
6	0.0752	—0.1262
7	0.0469	—0.0971
8	0.0279	—0.0738
9	0.0152	—0.0555
10	0.0068	—0.0415
11	0.0013	—0.0308
12	—0.0023	—0.0227
13	—0.0045	—0.0166
14	—0.0057	—0.0121
15	—0.0064	—0.0087
16	—0.0066	—0.0061
17	—0.0065	—0.0043
18	—0.0063	—0.0030
19	—0.0059	—0.0020
20	—0.0054	—0.0013

by the presence of the higher symetry states, but for our purpose we can disregard D-state (see for example Ref.[4,5] and charge form factor reads

$$F_{\mathrm{ch}}(^3\mathrm{He}) = \left(F^p_{\mathrm{ch}} + \frac{1}{2} F^n_{\mathrm{ch}}\right)(P_s^2 F_s + P_{s'}^2 F_{s'}) - \frac{1}{2} P_s P_{s'} (F^p_{\mathrm{ch}} - F^n_{\mathrm{ch}})_{s-s'} \qquad (1)$$

$$F_{\mathrm{ch}}(^3\mathrm{H}) = (F^p_{\mathrm{ch}} + 2F^n_{\mathrm{ch}})(P_s^2 F_s + P_{s'}^2 F_{s'}) + P_s P_{s'} (F^p_{\mathrm{ch}} - F^n_{\mathrm{ch}}) F_{s-s'} \qquad (2)$$

where the integrals F_s and $F_{s-s'}$ are given in Ref.[4] and in the Table, while $F_{s'}$ is given in Ref.[4] and is unimportante.

By direct inspection of the relations (1) and (2) and Table, one deduces the following conclusions:

1) for $P_{s'}^2 = 0$, the diffraction minimum apears at $11(\mathrm{fm})^{-2} < q^2 < 12(\mathrm{fm})^{-2}$ for both ^{3}H and ^{3}He nuclei.

2) for $P_{s'}^2 = 0.02$, the diffraction minimum is pushed back in q^2 for ^{3}He nucleus at $10(\mathrm{fm})^{-2} < q^2 < 11(\mathrm{fm})^{-2}$ and apears at $12(\mathrm{fm})^{-2} < q^2 < 13(\mathrm{fm})^{-2}$ for ^{3}H nucleus.

It is clear that the precise measurement of diffraction minimum for ^{3}H nucleus will determine the $P_{s'}^2$.

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4.7. Preliminary report about the work on ^{6}He + ^{1}H

R. POPIĆ, B. STEPANČIĆ and D. STANOJEVIĆ, *Institute »Boris Kidrič, Beograd*

The cross-section of ^{1}H(^{6}He, t)^{4}He reaction is determined for $E_{^6\mathrm{He}} = 0 - 5$ MeV by irradiating CH and CH$_2$ targets with ^{6}He particles obtained from the primary reaction ^{7}Li(t, ^{6}He)^{4}He. The relatively large differential cross section of 0.7 b/sr is explained by low Coulomb barrier and a probable two-neutron correlation.

4.8. ^{6}Li(t, p)^{8}Li reaction at low energies*

D. ĆIRIĆ, B. STEPANČIĆ, M. ALEKSIĆ, R. POPIĆ, D. STANOJEVIĆ and K. SUBOTIĆ, *Institute »Boris Kidrič, Beograd*

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