EXCITED STATE OF ^{15}C $J^{\pi} = 5/2^{+}$ NUCLEUS AND INELASTIC SCATTERING OF PROTONS

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The inelastic scattering amplitude (to the level $J^{\pi} = 5/2^{+}$) of protons on neutron-excess ^{15}C nucleus in the inverse kinematics was calculated within the framework of the Glauber diffraction theory. The terms of the first and second order were took into account in the operator of multiple scattering. We used the wave function (WF) of ^{15}C in a many-particles shell model [1]. The ground state of ^{15}C $\left(J^{\pi}, T = 1/2^{+}, 3/2\right)$ is 98% determined by the WF *s*-component, the first excited state $\left(J^{\pi}, T = 5/2^{+}, 3/2\right)$ is determined more than 90% by *d*-component. The main difference between the WFs of ground and the first excited states of ^{15}C nucleus is the location of the last neutron: when it fills the $2s_{1/2}$-orbital, the mean square radius of the last neutron and the total neutron density increases sharply compared with the case when the last neutron fills the $1d_{5/2}$-orbital (R_h = 3.845 fm for $1d_{5/2}$, R_h = 5.666 fm for $2s_{1/2}$ [2]). The reason is that the WF has one additional node at the $2s_{1/2}$-orbital that defines great extension of WF on the coordinate compared to the $1d_{5/2}$-orbital.

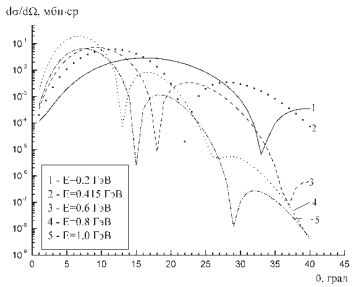

Figure. Differential cross-sections of inelastic p^{15}C-scattering at various energies.

The figure shows the DCS at the energies from 0.2 to 1.0 GeV/nucleon. At zero angle the scattering DCS tends to zero due to orthogonality of initial and final states WFs. With increasing of collision energy the diffraction peak narrows and there is more expressed diffraction pattern: if there are two minima at θ ~ 0° and 33° for E = 0.2 GeV/nucleon, then with increasing energy the minima are shifted to smaller scattering angles and their number increases.

1. N.A.Burkova *et al.* // Bull.Rus.Acad.Science. Phys. 2006. V.70. P.284.
2. T.Dong *et al.* // Phys. Rev. C. 2007. V. 76. 054602.