Neutron-deuteron scattering observables at E_{lab} =14.1 MeV

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We study the inelastic neutron-deuteron scattering on the basis of the configuration-space Faddeev-Noyes equations [1]. The Merkuriev-Gignoux-Laverne approach [2] is generalized for arbitrary nucleon-nucleon potentials and with an arbitrary number of partial waves. A new computational method is used for solving the nucleon-deuteron breakup scattering problem. This method is based on the spline-decomposition in the angular variable and the Numerov method for the hyperradius (see Ref. [3]). Neutron-deuteron observables are calculated with the Argonne AV14 nucleon-nucleon potential at the incident nucleon energy 14.1 MeV. Convergence of numerical results with respect to maximum value of the three-body angular momentum M is studied. Accuracy of elastic amplitudes computed is checked by using more detail grids in the angular variable. These amplitudes are applied for calculations of the elastic differential cross-section, and the nucleon A_y and deuteron iT_{11} analyzing power. The breakup amplitudes have been calculated under FSI configuration. To calculate elastic and breakup amplitudes, we take into account all orbital angular momenta of subsystems l and $\lambda \leq 4$, the total angular momentum of a pair nucleons $j \leq 3$, and the total three-body angular momentum M up to 13/2. For the elastic observables we have obtained a good agreement with results of the Bochum [4] and Grenoble [5] group. For the nd breakup scattering at E_{lab} =14.1 MeV the angular distribution and nucleon analyzing power A_y have been calculated. Our results are with qualitative agreement with the experimental data [6] and the results of the Bochum group [7].

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[1] S. P. Merkuriev, Theoretical and Mathematical Physics 8, 798 (1971); S. P. Merkuriev, Sov. J. Nucl. Phys. 19, 22 (1974); S.P. Merkuriev, Ann. Phys. (N.Y.) 130, 3975 (1980); S.P. Merkuriev, Acta Physica (Austriaca) Suppl. XXIII, 65 (1981).

[2] S.P. Merkuriev, C. Gignoux and A. Laverne, Ann. Phys. 99, 30 (1976).

[3] V.M. Suslov, M.A. Braun, I.N. Filikhin, and B. Vlahovic, Nucl. Phys. A790, 699 (2007).

[4] H. Witala, private communication.

[5] J. J. Benayoun, J. Chauvin, C. Gignoux, and A. Laverne, Phys. Rev. Lett. 36, 1438 (1976).

[6] M. Karus et al., Phys. Rev. C31, 1112 (1985).

[7] H. Witala, W. Glckle, and Th. Cornelius, Phys. Rev. C39, 384 (1989).

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