0. $^12\text{C}$ nucleus: Faddeev calculation in configuration space

BRANISLAV VLAHOVIC, IGOR FILIKHIN, VLADIMIR SUSLOV, North Carolina Central University, Durham, NC 27707, US — The α-cluster model and Faddeev equations in configuration space are applied to study the $^{12}\text{C}$ nucleus. The model includes the Ali-Bodmer nuclear potential [1], attractive three-body potential, and takes into account the Coulomb interaction. An s-wave model [2] is adapted and parameters of the three-body potential are chosen to describe the first two $0_+^+$ levels of $^{12}\text{C}$. The value of the range parameter of the potential is adjusted to reproduce the position of diffraction minimum for the elastic form factor of $^{12}\text{C}$. The model assumes a strong distortion of the charge density of α clusters inside the $^{12}\text{C}$ nucleus. It was found that the most probable configuration of the α-clusters in the $0_+^+$ state corresponds to an equilateral triangle with sides as large as 3.5 fm and in the $0_2^+$ state to a linear chain with the values of 2.9 fm and 13.1 fm for each link. Having calculated low-lying levels of $^{12}\text{C}$, we found that the contributions of higher partial waves of nuclear interaction to the energy of 3α-system are unnaturally large and some states turn to be overbound. Upon applying the method [3] based on the Pade approximation we got satisfactory description for the $0_3^+$ and $0_4^+$ states [4]. Additional $0^+$ broad resonance obtained in [3] was not found. 1. S. Ali, A. R. Bodmer, Nucl. Phys. 80, 99 (1966). 2. Z. Papp, et al. Few-Body Systems 30, 31 (2001). 3. C. Kurokawa and K. Kato, Phys. Rev. C76, 021301-1 (2005). 4. http://www.tunl.duke.edu/nucleardata/.

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