Contribution ID: **41** Type: **Oral**

ANCs of the 11B+p overlap from the p-transfer reactions with d and 3He projectiles

Wednesday 2 July 2025 12:30 (20 minutes)

The structure of excited states and even their energy spectrum for the 12C nucleus, oddly enough, is still the subject of consideration [1, 2]. The problem is that a number of poorly identified broad resonance states lying above the Hoyle state (7.65 MeV, 0+) and having an α-cluster structure overlap significantly. Against their background there are a number of levels lying below the nucleon separation thresholds and having pronounced signs of a single-particle structure. However, their spectroscopic factors determined from nucleon transfer reactions (mainly performed in the 70s-90s) demonstrate a spread of values reaching a factor of 3 or more - see for example [3]. At the same time such reliable information is necessary not only for understanding the structure of the 12C nucleus but also from a nuclear astrophysical point of view due to the enormous role of the 12C nucleus in the pathways of nucleosynthesis and the search for alternative pathways of its formation, for example, the capture of a nucleon by the 11B nucleus [4, 5].
In this paper we present the values of the asymptotic normalization coefficients (ANC) of proton coupling from the analysis of suitable literature experimental differential cross sections (DS) of reactions in proton transfer reactions on beams of the lightest ions (including the DS we obtained at energies E3He = 22.3 and 32.5 MeV) leading to such states. The calculations were performed within the framework of the modified DWBA [6] using the DWUCK5 [7] and Fresco [8] codes taking into account the deuteron breakup in the reactions (d,p) and (p,d). The obtained ANC values were compared with previously available data [9] and new values were obtained for the states E* = 10.84 (1-), 11.83 (2-) and 14.08 (4+) MeV where these values were not determined earlier. The values of the squares of the ANC for the 12C states, obtained from the analysis of the reactions (d,n), (3He,d) and reverse reactions for the ground state (0+) and the 4.44 MeV state (2+) where the transfer process is non-peripheral due to the tight coupling of these states differ by ~ 1.5 times. For the remaining states up to the proton separation energy (εp= 15.957 MeV) the ANC values turned out to be close to each other.
References:

1. K.L. Laursen et al., Eur. Phys. J. A 52:370 (2016).
2. J.H. Kelley, J.E. Purcell, C.G. Sheu, Nucl. Phys. A 968, 71 (2017).
3. G. H. Neuschaefer et al., Phys.Rev. C28, 1594 (1983).
4. L.H. Kavanaugh et al., Astrophys.J., 372, 1 (1991).
5. J.H. Kelley et al., Phys, Rev. C 62, 025803 (2000).
6. S.V. Artemov et al., Eur. Phys. J. A 58:24 (2022).
7. P.D. Kunz, University of Colorado,«Computer code DWUCK5», http://spot.colorado.edu/ kunz/DWBA.html
8. I.J. Thompson FRESCO, Подразделение of Physics, University of Surrey, July 2006, GuildfordGU27XH, England, version FRESCO 2.0, http://www.fresco.org.uk/
9. S.V. Artemov et al., Bull. of the Rus. Acad. of Sci.-Physics V67, 1741 (2003).

Primary author: ARTEMOV, Sergey (Institute of Nuclear Physics, 100214, Ulughbek, Tashkent, Uzbekistan)

Co-authors: SON, Irina (Institute of Nuclear Physics, 100214, Ulughbek, Tashkent, Uzbekistan); TOJIBOEV, Olimjon (Institute of Nuclear Physics, 100214, Ulughbek, Tashkent, Uzbekistan); KARAKHODJAEV, Ahror (Institute of Nuclear Physics, 100214, Ulughbek, Tashkent, Uzbekistan); ERGASHEV, Feruzjon (Institute of Nuclear Physics, 100214, Ulughbek, Tashkent, Uzbekistan); IGAMOV, Sayrambay (Institute of Nuclear Physics, 100214, Ulughbek, Tashkent, Uzbekistan)

Presenter: SON, Irina (Institute of Nuclear Physics, 100214, Ulughbek, Tashkent, Uzbekistan)

Session Classification: 2. Experimental and theoretical studies of nuclear reactions

Track Classification: Section 2. Experimental and theoretical studies of nuclear reactions.