LXXII International conference ”Nucleus-2022: Fundamental problems and applications”

Contribution ID: **69** Type: **Oral talk (15 min + 5 min questions)**

INFLUENCE OF NUCLEON PAIRS ON THE NUCLEAR SURFACE TENSION

Thursday, 14 July 2022 16:20 (20 minutes)

The calculation of the surface tension coefficients σ of even-even nuclei [1] showed the decisive role of shell effects in the formation of the value of σ. The addition of neutron pairs to the “magic” nucleus leads, as a rule, to a decrease in σ (Fig. 1). Low values of σ change little upon addition of neutron pairs until a neutron-closed subshell is obtained, when the surface tension sharply increases (Fig.1a).

Fig.1a. Surface tension of Ca, Ar and Ti nuclei Fig.1b. Surface tension of C and O
The role of proton pairs in the formation of surface tension is more controversial. Adding a pair of protons to a closed protons shell leads to a significant decrease in σ [σ(18O)/σ(20Ne)≈4.5; σ(48Ca)/σ(50Ti)≈5.5]. The surface tension of the nucleus, as a rule, increases if the addition of a pair of protons completes the shell to closeness [σ(40Ca)/σ(38Ar)≈3.3;], however, the addition of a pair of protons to the 14C nucleus leads to a decrease in σ (Fig. 1b), although in this case a closed proton subshell is formed. The relatively low value of σ for the 16O nucleus is the source of the formation of a complex structure of giant resonance in this nucleus, which has not been adequately explained in terms of the many-particle shell model [2,3]. The influence of the shell structure on the surface tension of heavy stable nuclei is clearly manifested in mercury and lead isotopes: the surface tension coefficient σ more than triples when a pair of protons (3s)2 is added to the 204Hg nucleus and the “magic” number of protons 82 is formed. Completing the construction of the lead’s neutron shell up to N=126 leads to an even sharper increase in σ and the achievement of the maximum of this coefficient among all nuclei: σ(126Pb)≈34MeV/fm2.

1. N.G. Goncharova, Phys. Part. Nucl. 50, 532 (2019).
2. G.E. Brown, M. Bolsterly, Phys. Rev. Lett. 3, 472 (1959).
3. N.G. Goncharova, Phys. At. Nucl. 85,75 (2022).

The speaker is a student or young scientist

No

Section

1. Nuclear structure: theory and experiment

Primary author: Prof. GONCHAROVA, Natalia (MSU)

Presenter: Prof. GONCHAROVA, Natalia (MSU)

Session Classification: Nuclear structure: theory and experiment