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DETERMINATION OF THE PATTERN OF NUCLEAR BINDING FROM THE DATA ON THE LEPTON-NUCLEUS DEEP INELASTIC SCATTERING

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Determination of the Pattern of Nuclear Binding from the Data on the Lepton-Nucleus Deep Inelastic Scattering

Nucleon structure function ratios $r^A(x) = F_2^A(x) / F_2^P(x)$ measured in the range of atomic masses $A \geq 4$ are analyzed with the aim to determine the pattern of the $x$ and $A$ dependence of $F_2(x)$ modifications caused by nuclear environment. It is found that the $x$ and $A$ dependence of the deviations of the $r^A(x)$ from unity can be factorized in the entire range of $x$. The characteristic feature of the factorization is represented with the three cross-over points $x_i$, $i = 1 - 3$ in which $r^A(x) = 1$ independently of $A$. In the range $x > 0.7$ the pattern of $r^A(x)$ is fixed with $x_1 = 0.84 \pm 0.01$. The pattern of the $x$ dependence is compared with theoretical calculations of Burov, Molochkov and Smirnov to demonstrate that evolution of the nucleon structure as a function of $A$ occurs in two steps, first for $A \leq 4$ and second for $A > 4$. The long-standing problem of the origin of the EMC effect is understood as the modification of the nucleon structure in the field responsible for the binding forces in a three-nucleon system.

The investigation has been performed at the Laboratory of Particle Physics, JINR.