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ON SHORT-RANGE CORRELATIONS IN ATOMIC NUCLEI

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Atomic nuclei, to be drops of a Fermi liquid, have a number of properties in common with liquid drops of 3He atoms, as well as with electrons in metal clusters. For example, their energy levels have a similar shell structure and are characterized by the same magic numbers: 2, 8, 20 etc. [1]. Besides, they all contain an admixture of the two-fermion short-range correlations (2F-SRC) which are pairs of fermions having a momentum up to 2.5 times greater than the Fermi momentum, though a magnitude of their sum takes values expectable in the ideal Fermi gas model. The 2F-SRC arise naturally as corrections to the ideal Fermi gas model at taking into account a repulsion of fermions in the form of a non-zero scattering length at short ditances [2]. Since most of the time such fermions are in the free flight, it was natural to assume that there must also exist a quasi-free knocking out one of them from a 2F-SRC pair at its hard collision with a projectile. Until now this mechanism has been considered the most plausible at the interpretation of experimental data on the scattering of leptons and hadrons in atomic nuclei within the framework of the 2F-SRC model, see, e.g., [3,4]. Our analysis of the experiment [4], however, has shown that the nucleons of the SRC pair which had large momentum (of the order of 550 MeV/c) were in a mutual potential well with a depth of about 300 MeV at the instant of their knocking-out. It is easy to calculate that before entering the potential well, the nucleons must have had a momentum much less than the Fermi one. It follows from this that the generally accepted interpretation of the short-range correlations in atomic nuclei is hardly applicable.

In the presented report, the question is discussed to what extent the assumption of the existence of such a deep potential well is compatible with modern phenomenological models of the N-N interaction. It is indicated that there is a natural possibility of estimating the size of the potential well from the registration of quasi-bound states with a nonzero orbital momentum, formed by multiple reflections of nucleons from its boundary. This physical picture can be also appropriate for interpreting experimental hints on the existence of light dibaryons with a mass below the meson production threshold [5].

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The speaker is a student or young scientist

No

Section

1. Nuclear structure: theory and experiment

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