case.

[18]There may actually be six levels in addition to the zeroth level. If two directions of the ring current were produced and the two junctions were of unequal strength, the peaks in the histogram would presumably be broadened or split.

[19]An exact comparison of these results with the theory presented is not possible, as it would be necessary to generalize the theory to include the case in which a significant fraction of the field energy is contained within the junction region.

[20]As the lead films are ~2000 Å thick, current contributions to the phase in the body of the ring do not reduce the flux quantum significantly.

STRUCTURAL SIGNIFICANCE OF THE PRINCIPAL QUANTUM NUMBER OF NUCLEONIC ORBITAL WAVE FUNCTIONS

Linus Pauling*

Center for the Study of Democratic Institutions, Santa Barbara, California
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In the course of a study of the packing of nucleons and clusters of nucleons, I have formulated an interpretation of the principal quantum number n of nucleonic orbital wave functions (equal to n_r+1, with n_r the number of nodes in the radial wave function[1]) that is, I believe, both new and useful.

The study is based on the assumption that nucleons in nuclei are for the most part clustered into spherons. A spheron consists of nucleons in a localized 1s orbital. The principal spherons are the helion (alpha particle) and the triton.

The nucleus $_{26}Fe_{26}$ has diameter three times that of the helion. It can reasonably be described as having one helion at its center, surrounded by a mantle (outer layer) of 12 helions. Somewhat heavier nuclei may be assigned a three-layer structure, consisting of an inner core of spherons, an outer core, and a mantle.

The qualitative nature of radial wave functions is largely independent of the assumed shape of the nuclear potential well. For a given value of the azimuthal quantum number l, the nucleon distribution function for $n=1$ corresponds to a single shell (for 1s a ball) about the origin. For $n=2$ the radial wave function has a small negative value inside the nodal surface, that is, in the region where the wave function for $n=1$ and the same value of l is large, and a large value in the region just beyond this surface.

This property of the radial wave functions has led me to the following interpretation of the subshells of the shell model[2] of the atomic nucleus:

(1) Those subshells that occur (are occupied) with only the value 1 for the principal quantum number n contribute only to the outer layer of the nucleus (the mantle).

(2) Those subshells that occur with two values of n contribute to the mantle and the next inner layer, and so on.

(3) For given n, the subshells are filled in the order of increasing l, and for given l in the order of increasing n.

For example, the shell-model assignment of the configuration for both neutrons and protons in $_{26}Fe_{26}$ is $1s^2 1p^6 1d^{10} 2s^2 (1f_{7/2})^6$. The above rules assign $1s^2$ to the core and the remaining nucleons to the mantle, in agreement with the description given above. Similarly, for the magic number 50, with configuration $1s^2 1p^6$-$1d^{10} 2s^2 1f^{14} 2p^6 (1g_{9/2})^{10}$, the rules assign $1s^2 1p^6$ to the core and the remainder to the mantle, corresponding to a core of four spherons and a mantle of 21 spherons.

The use of this postulate in the discussion of the properties of nuclei will be published in other journals.[3]

*Fellow of the John Simon Guggenheim Memorial Foundation.

[1]This is the customary usage for nucleons; for electrons in atoms n is taken to be n_r+l+1.

[2]M. Goeppert Mayer and J. H. D. Jensen, Elementary Theory of Nuclear Shell Structure (John Wiley & Sons, Inc., New York, 1955).

[3]Nature, to be published (the structural significance of the magic numbers); Proc. Natl. Acad. Sci. U. S., to be published (ranges of values of nucleon numbers for occupancy of subshells); Science, to be published (Z/N ratio, prolate deformation, symmetric and asymmetric fission).