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To understand atomic nucleus from a new nuclear structure modelXiaodong Li, Qijun Liu, Gongyi Li, Yihe Li and Zengyong Chu
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To explain some very basic facts of atomic nucleus, such as the stability of isotopes, the even-odd variation in many properties and so on, a nuclear structure model of ring plus extra nucleon is proposed. For nuclei larger than ${}^4\text{He}$ inclusive, protons (P's) and neutrons (N's) are basically bound alternatively to form ${}^{2Z}_Z\text{E}$ ring. The ring folds with a bond angle of 90° for every 3 continuous nucleons to make the nucleons packed densely. The ring must be identical when all the P and N interchange (negative symmetry). Extra N(s) can bind to ring-P with the same manner. When 2 or more ring-P's are geometrically available, the nuclide with extra N tends to be stable. Extra P can bind with ring-N in a similar way when the ratio of $N/P < 1$ although the binding is much weaker. Even-Z rings always have superimposed gravity centers of P and N; while for odd-Z rings, both centers of P and N must be eccentric. The eccentricity results in a depression of E_b and therefore specific zigzag features of E_b/A . This can be well explained by the shift of eccentricity by extra nucleons. Symmetrical center may present in even-Z rings and normal even-even nuclei. While for odd-Z ring, only antisymmetric center is possible. Based on this model, a pair of mirror nuclei, ${}^{P_{X+n}}_X\text{N}_X$ and ${}^{P_X}_{X+n}\text{N}_{X+n}$, should be equivalent in packing structure just like black-white photo and the negative film. Therefore, an identical spin and parity was confirmed for hundreds of pairs. In addition, the E_b/A difference of all the mirror nuclei pair is very nearly a constant of $0.184n$ MeV. Many other facts can also be easily understood from this model, such as the nuclear stabilities of isotopes in elements from He to Ne; the stability sequence of ${}^9\text{Be}$, ${}^{10}\text{Be}$, ${}^7\text{Be}$ and ${}^8\text{Be}$; the neutron halo in neutron-rich nuclides, the general rule for most stable isotopes: Odd-Z elements are odd A, even-Z elements are even A; and the highest cohesive energy of Li, Be, B atoms in their own elementary group and so on.

Biography

Xiaodong Li is a PhD holder from Universite de Montreal and MS from Nankai University. He is teaching in NUDT as a Professor with the research fields of Polymer Chemistry, Material Chemistry and Physics. He has published more than 100 papers in reputed journals.

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