The Electromagnetic Considerations of the Nuclear Force, Part II: The Determination the Lowest Energy Configurations for Nuclei

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This paper is Part II of a series of papers, describing the concepts of the Electromagnetic Model of the nuclear force—that force which holds together the nucleons in a nucleus. The Electromagnetic Model claims that the nuclear force is a direct result of the electromagnetic forces of the quarks within the nucleons. Part I of this series, "The Electromagnetic Considerations of the Nuclear Force" explains how the electromagnetic force is able to achieve nuclear bonding, when quarks are considered. Historical objections and common misconceptions regarding the electromagnetic force within nuclei are answered and clarified in the first paper of this series [1].

In this second paper, the lowest energy configurations of the nuclides are determined by using the laws of electromagnetics. The lowest energy configuration of hundreds of nuclei, from ^{2}H to ^{250}Ca, have been determined, computer-modeled, and simulated by applying the laws of electromagnetics to the quarks. For the lowest energy configurations of the nuclides, a pattern emerges in which there are basic building blocks, AKA segments or clusters, within the nuclides. These building-block segments are linked together in a chain-like manner, to form what are known as "nuclear molecules". This finding of clustered segments is very similar to the concepts of the Cluster Model of the nucleus [2]. Recent research, both theoretical and experimental, regarding the Cluster Model has shown that cluster-type structures do indeed exist within nuclei [3-5].

By applying the equations of the electromagnetic energy to the positively-charged and negatively-charged quarks that are within each nucleon, analytical predictions can be made about the lowest energy configuration of the nuclides. Simply described, the lowest energy configuration is with the most number of quark-to-quark bonds formed, and with the net positive charge of the nucleus spread out as far as possible, while still maintaining the bonds. Any negative charge, such as that found on an unbonded down quark, tends to be situated within the highest concentration of positive charge. This paper describes how the various possible lowest energy configurations are tested and compared with one another, in order to determine which configuration is actually the lowest energy configuration. Thus, the configurations described in this paper are not mere speculation, but rather they represent the lowest energy configuration of the nucleons when taking into consideration the laws of electromagnetics, as applied to the quarks.

From carbon ^{12}C upwards, the stable nuclides follow a straightforward pattern, and can be described by a few simple rules:

- There is one alpha-particle segment for every two protons and two neutrons.
- If the number of protons is odd, then contained within the configuration there is one tritium-segment, made of one proton and two neutrons. This tritium segment has one negatively-charged unbonded down quark.
- When there are more neutrons than protons, the extra neutrons form single-neutron segments, each with a negatively-charged unbonded down quark. These single-neutron segments are interspersed between the net positive charge of the alpha segments, thereby lowering the net repulsive Coulomb energy of the nuclide.
- When the number of protons and the number of neutrons are equal to each other and both are odd, such as nitrogen ^{14}N, then there is a single neutron segment plus a single proton segment. This situation is rare for stable nuclides.
- Unbonded down quarks are nearer the middle of the configuration, allowing the net positive charge to be slightly more spread out.

Contrary to outdated conventional models of the nucleus—such as those that do not acknowledge the existence of quarks—this model proposes that an inherent structure exists within each nuclide, and that this structure strongly influences the nuclear behavior of the nuclide. For example, this model is able to achieve excellent predictions of binding energy, using only one variable. The binding energies of these nuclei have been calculated and compared to experimental data; the calculated binding energies agree with the experimental binding energies within a few percent. No other currently-accepted model of the nuclear force has been able to demonstrate such a tight prediction of binding energy using only one variable. Also, by examining the structural configurations of each nuclide, we can gain a better understanding of numerous other nuclear behaviors—behaviors that are a direct consequence of the electromagnetic forces acting within that structure. Thus, by identifying and recognizing the inherent structure within each nuclide, we can achieve more rigorous and accurate predictions of nuclear behavior. This, in turn, can give us a better understanding of Low Energy Nuclear Reactions.

References:

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