Discrepancies with the Recent Models of Nucleons

N. L. Bowen[1]
[1]Colorado Mountain College, Glenwood Springs, Colorado, USA
*corresponding author, e-mail: nbowen@coloradomtn.edu

Experimentally it has been found that the mass of a proton is roughly 100 times greater than the sum of the rest masses of the three quarks that make up the proton. Similarly for a neutron—the three constituent quarks of the neutron comprise only a small percentage of its mass. Because of these unexpected findings, recent models of the nucleons have been proposed in an attempt to explain what makes up this 99% missing mass. However, these new models unfortunately also consist of much confusion and misinformation.

The recent models of the nucleons and their quarks typically claim one or more of the following three concepts:
Concept one: This concept claims that the missing mass is made up of the mass of the binding energy. This binding energy has mass due to the relativistic energy/mass equivalence equation, $E=mc^2$. In other words, the models claim that the binding energy holding the quarks together inside of the nucleon has mass, and furthermore, that this binding energy mass therefore makes up 99% of the mass of the proton and/or neutron.
Concept two: This concept claims that the three quarks are moving at relativistic speeds with extremely large amounts of kinetic energy. This extreme relativistic speed inflates the mass of the quarks, due to the equations of special relativity. This mass inflation of the quarks makes up the missing 99% of the mass of the nucleons.
Concept three: This concept claims that there are hundreds more quarks, inside the nucleons. These additional quarks make up the remaining 99% of the mass.
All of these concepts have inherent problems, as discussed below.

Concept One: This concept claims that the binding energy makes up the missing 99% of the nucleon mass. The unfortunate problem with this claim is that there is a sign error when accounting for the binding energy of the quarks inside the nucleon. Binding energy is the energy which acts on a group of particles, such as three quarks, holding them together in a stable configuration, such as a proton. Regardless of what type of energy—quantum, electromagnetic, gravitational—that this binding energy must be subtracted from the mass of its constituent components. The mass of the binding energy is not added to the mass of the particles that it binds, rather it is subtracted. This sign error creates a significant problem with these models, namely a blatant violation of thermodynamics and conservation of energy. Specifically, when particles are held together by binding energy and bound in a stable configuration, they are in a lower energy state than when they are separated and isolated. In other words, there is a decrease in the overall total energy of the bound configuration of particles.

When that bond was formed, energy was released to the external environment. And if that bond is to be broken to separate the configuration of particles, an externally applied amount of energy is required to break that bond. Thus, the bound particles are in a lower energy state, and therefore, at a lower mass. Recall, energy and mass are equivalent and can be thought of as simply different units of measurement; if the energy goes down, then the mass goes down. Stated succinctly, the binding energy is subtracted from, not added to, the mass of the object. Quantum physics does not to claim that conservation of energy can be violated. Quantum uncertainty can violate conservation of energy for only an extremely short duration of time, and then quantum uncertainty must give back any energy it took during that brief time. Quantum uncertainty must still abide by conservation of energy, especially for long durations of time and for large values of energy. Thus, quantum uncertainty cannot and does not explain the excess mass of the proton.

Concept Two: This concept claims that relativistic mass inflation makes up the missing 99% of the nucleon mass. In other words, if the three quarks move at extremely fast relativistic speeds, they inflate their mass relativistically and become much more massive. The problem is, in order to get this much relativistic mass, the quarks need to go 0.99995 times the speed of light. If the quarks are moving that fast, they would instantly be hurled out of the proton, due to their excessive momentum. This problem can only be resolved if the binding energy is stronger than this relativistic mass-inflating energy. Thus, in order to prevent the quarks from being hurled out of the proton, we need a binding energy that is stronger than this relativistic mass-inflating energy. In other words, in order for the proton to be stable, the net sum of these two conflicting energies must still produce a mass that is less than the mass of the constituent parts. The relativistic energy needed for the mass inflation competes with binding energy in a tug-of-war. For the proton to be stable, the mass must have a net decrease.

Concept Three: Hundreds of additional non-valance quarks make up the missing mass, and the addition of hundreds of more quarks will add more mass. The problem now is that every one of these additional quarks violates Pauli exclusion principle. Also, all of these hundreds of quarks violate the Copenhagen Interpretation of the Heisenberg Uncertainty Principle. Thus, the addition of hundreds of non-valence quarks into the proton violates two of the foundational stanchions of quantum physics.

As a starting point for understanding of nuclear physics, nuclear scientists utilize the nucleon models as the basic building blocks for understanding nuclear physics. Thus, for a better understanding of nuclear physics—and in particular for LENR—the currently-accepted models of the nucleons must be free of blatant violations of thermodynamics, conservation of energy, and modern physics. When trying to account for the various energies and masses, the recent models are severely flawed and unacceptable. Thus, they do not provide a coherent or consistent model that can be used as a basis for nuclear physics. In order for progress in the field of nuclear physics to advance, models such as these should not and cannot be promulgated or endorsed as being correct.