Simulation of the Nuclear Transmutation Effects in LENR

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LENR phenomena begin with a still poorly-understood entrance of a fermion/boson into the nuclear interior. One such mechanism – the thermal neutron-induced fission of uranium – was discovered in 1938 and subsequently revolutionized global military conflict and international politics [1]. Modern research indicates the reality of *multiple* LENR mechanisms in small and medium-sized nuclei [2], promising another revolution in energy production. Conceptually, LENR implies an expansion of the "central dogma" of the dynamics of atomic systems, ca. 1932, to a dogma that includes a mechanism of nuclear excitation by particles that enter the nucleus through the atom's own electromagnetic periphery [3] (the solid arrow): Neutrons ⇦ ⇨ Protons ⬅ ⇨ Electrons

While the production of radiation-free heat is the focus of most technological developments in LENR, the unambiguous demonstration of specifically *nuclear* effects remains an essential step for the acceptance of LENR into mainstream physics. For this reason, we have concentrated on the theoretical explanation/simulation of the nuclear transmutation effects reported in the LENR literature [2, 4]. In chronological order, we have previously simulated: (i) the asymmetrical fission fragments produced by the thermal fission of uranium and plutonium [5], (ii) the LENR transmutation products detected on palladium cathodes [3], and (iii) the recently-reported [6], *anomalous* asymmetrical fragments from the spontaneous fission of ^{180}Hg [7] (for which both the shell model and the liquid-drop model predict symmetrical fragments [6]).

In the present study, we have undertaken simulations of the "anomalous" products that have been measured in "piezonuclear fission" experiments on non-radioactive rocks, such as granite and marble, e.g., [8]. The experimental data on isotopes and neutron radiation have been reported by Carpinteri and colleagues in 12 publications in refereed physics journals (2009~2012) and the lattice model and simulation technique have been reported by Cook and colleagues in 30 publications in refereed physics journals (1976~2011). In brief, the essential theoretical argument is that the complexities of nuclear structure theory can be succinctly summarized within a specific nucleon lattice, which can then be used to make predictions concerning nuclear structure and nuclear reactions, i.e., a quantitative theory of the nucleus, quantum nucleodynamics [9]. With regard to piezonuclear fission, the lattice structure for ^{56}Fe necessarily contains a set of lattice planes along which fracture can occur. By calculating the binding energy along each lattice plane, the probability of producing various fission fragments can be determined. The dominant products from the fission of ^{56}Fe were symmetrical: ^{24}Mg, ^{27}Al and ^{28}Si. A full report of the simulation will appear in [10].

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