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Nuclear Energy in an Atomic Lattice

—— *Causal Order* ——

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The extremely small penetrability of the Coulomb barrier is generally adduced to dismiss the possibility of low energy (cold) fusion. The existence of other mechanisms that could invalidate this logic is pointed out.

The idea that adjacent isotopes of hydrogen, bound within a palladium lattice, can undergo significant nuclear reactions is generally dismissed as a violation of known physical laws. That conviction is based largely on the extremely small probability, as conventionally estimated, for penetrating the Coulomb barrier with energies at the atomic level. Implicit in this line of thought is the apparently self-evident causality assignment that has the release into the surrounding environment, of energy at the nuclear level, occur after the penetration of the Coulomb barrier. One would hardly question that time sequence when the environment is the vacuum. But does it necessarily apply to the surrounding ionic lattice?

To set the stage for a response, I quote from a paper delivered at the Yoshio Nishina Centennial Symposium:[1)]

"…the loading of deuterium into the palladium lattice does not occur with perfect spatial uniformity. There are fluctuations. It may happen that a microscopically large —if macroscopically small— region attains a state of such lattice uniformity that it can function collectively in absorbing the excess nuclear energy that is released in an act of fusion."

It would seem that conventional causality is assumed here. But, another reading is possible, one in which the causal order is reversed. Why? Because, in contrast with the vacuum, the lattice is a dynamical system, capable of storing and exchanging energy.

The initial stage of the new mechanism can be described as an energy fluctuation, within the uniform lattice segment, that takes energy at the nuclear level from a *pd* or *dd* pair and transfers it to the rest of the lattice, leaving the pair in a virtual state of negative energy. This general characterization becomes more explicit in the language of phonons. The non-linearities associated with large displacements constitute a source of the phonons of the small amplitude, linear regime. Intense phonon emission can leave the particle pair in a virtual negative energy state.

For the final stage of the new mechanism, consider the *pd* example where there is a stable bound state : ^{3}He. If the energy of the virtual state nearly coincides with that of ^{3}He, a resonant situation exists, leading to amplification, rather than Coulomb barrier suppression.

It would seem that two mechanisms are available, characterized by different causal orderings. But are they not extreme examples of mechanisms that in general possess no particular causal order?:[1)]

"…one is dealing, essentially, with a single wavefunction, which does not permit such factorization."

It is not my intent —nor would I be qualified— to declare the reality of the evidence offered for what has been called cold fusion. Rather, I only point out that the argument that has produced contemptuous dismissal of the possibility could be based on a false premise. The subject requires research, not fiat.

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1) J. Schwinger, *Cold Fusion —Does It Have a Future?* in *Evolutional Trends of Physical Science* (Springer,Verlag, 1991).