

# Quantum Fusion Hypothesis

Robert E. Godes  
*Profusion Energy*

## Abstract

The field of cold fusion is not “fusion” as the current establishment defines it.

A basic tenet of research is that correlation does not equal causation. The current assumption of Deuterium Deuterium (DD) fusion based on the excellent work of Dr. Michael McKubre showing a near perfect match of excess heat to helium produced is only a correlation. The assumption of DD fusion may be fallacious and leading to a dead end. In many cases the Pons Fleischmann reaction starts with deuterium and ends with helium. This would seem to indicate DD fusion, but this is assuming that correlation equals causation.

## Related Fields

The Quantum Fusion (QF) Hypothesis explains the Fleischmann-Pons Effect and a large cross section of experiments researchers in this field have observed. It is an explanation of how cold to ultra cold neutron(s) form. QF draws on work in the fields of mechanics, chemistry including molecular, quantum and computational, material science, physics, including quantum and astro, and electronics. Depending on your background, recognition of different aspects of what is presented in this paper will vary. This paper is written for people with a scientific background to understand what underlies the phenomena and how to drive it. Understanding the phenomena requires integration of many concepts across the fields mentioned above. There are some systems that may operate on different principals and have not yet been analyzed relative to the Quantum Fusion hypothesis. Edmund Storms’ plasma discharge work may fall into this category. I believe that the Quantum Fusion hypothesis is correct for many of the systems this community has been investigating. Details may be found on-line in Ref [1].

## Testing the hypothesis

Profusion Energy built and ran several prototype reactors in open beakers in a partially controlled environment. Tests used both electric heaters and copper reactor cores for comparison. Systems with nickel or palladium cores can always outperform both electric heaters and copper core devices regardless of the position in the testing environment.

## Typical results

Figure 1 shows a 0.05 mm Pd core system outperforming an electric heater. All power into the Quantum Fusion reactor is considered strictly as power into the beaker. The loss caused in the generation of oxygen and hydrogen gas was ignored. The power drawn off of the Q or Quantum compression supply (Q power discussed later) was calculated as power into the beaker even though the circuitry generated significant heat outside the beaker. The Quantum Fusion system

still outperformed the electric heater, which turns every watt second of power into 1 joule of heat energy.

### Beaker Temperature with 22 Watt Input

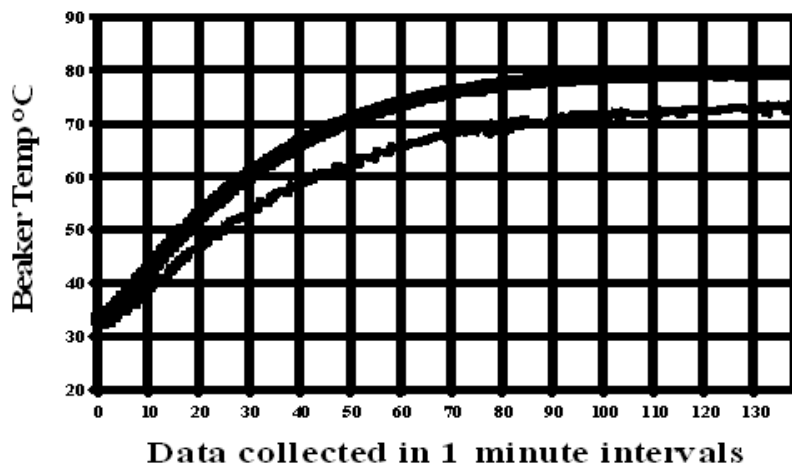


Figure 1. A 0.05 mm Pd core producing more heat than an electric heater.

### Molecular Hamiltonian

In atomic, molecular, Quantum, and optical physics as well as in quantum chemistry, molecular Hamiltonian is the name of the operator representing the energy of the electrons and nuclei in a molecule (to be taken as the trapped nuclei and lattice elements in a unit cell of the matrix running the reaction). This equation plays a central role in computing properties of molecules and aggregates of molecules such as conductivity, optical, and magnetic properties, and reactivity. By quantizing the classical energy in Hamilton form, one obtains a molecular Hamilton operator. This Hamiltonian is a sum of 5 terms<sup>1</sup>. This was a handy starting point but is used to describe systems in equilibrium. When the molecular system is moved away from equilibrium, nonlinear effects begin to dominate.

In general, evaluation of a Hamiltonian results in another function. The function of the QF Hypothesis includes terms not previously included in a Hamiltonian because QF addresses a system far from equilibrium. In the solution space of this expanded Hamiltonian there are absolute values greater than 782KeV and up to 9.3 MeV. You may recognize 782KeV as the mass difference between the sum of a proton and an electron and the mass of a neutron. At first glance 9.3 MeV may seem preposterous, however it is no more preposterous than 80+GeV for the well-accepted W bosons. The energy is concentrated by virtue of being a compression function. Deuterons may require up to 3 MeV and Tritons up to 9.3 MeV.

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<sup>1</sup> The sum of all kinetic energy operators for each nucleus, electron, electrons and nuclei interaction, electron- electron interaction, and nuclei-nuclei interaction in the system

## Material science

The elements and materials that support the Fleischmann-Pons Effect have the following shell similarities in common. They have a full or nearly full  $D_n$  shell and an empty or at least room in the  $S_{(n+1)}$  shell. Palladium is the only element in the periodic table with a full  $D_n$  shell  $D_4$  and an empty  $S_{(n+1)}$  or  $S_5$  shell in the ground state. I believe that this  $S_{(n+1)}$  orbital energy well represents the trapping points that hydrogen occupies in the materials that support the Fleischmann-Pons Effect. Hydrogen will pass through palladium but helium will not. As atoms go, helium is about  $\frac{1}{2}$  the size of hydrogen, yet it will not pass through palladium and hydrogen will. It has been shown that hydrogen actually enters with a fractional charge or less than one electron per hydrogen nuclei entering the lattice. One way to visualize the transport of hydrogen through palladium is as an external gear pump mechanism.

The tear dropped shaped P orbitals act like the teeth of an external gear pump and the D orbitals in combination with the lattice nuclei act as the casing. There is only room for a single hydrogen nuclei in-between each set of P orbital teeth. The walls of that “space” are a combination of electrostatic repulsion of the lattice nuclei and the  $P_{(n)} D_{(n)}$  electron wave functions. Hydrogen nuclei can easily tunnel to an adjacent lattice element site in palladium providing extraordinary mobility within the palladium lattice. Given this extraordinary mobility, it is inconceivable that two hydrogen nuclei would occupy the same octahedral point and fuse at a loading ratio of less than 3. What trapping in the octahedral points **does do** is limit the uncertainty or standard deviation of the position of the hydrogen nuclei. All the hydrogen loving lattice structures that support the transmutation of elements have this trapping capability.

## Heisenberg uncertainty formula

As it turns out, the greater than symbol used in the Heisenberg uncertainty formula is correct. If one variable is forced to an extremely or a “super” low value, the uncontrolled variable becomes large. In a Bose-Einstein condensate, super cooling a cloud of evaporated atoms achieves a very small  $\Delta p$  or uncertainty of momentum or energy. To satisfy  $\Delta p \Delta q$  or uncertainty of momentum times uncertainty of position  $\geq h / 4\pi$  (Heisenberg Uncertainty Principle), a very large  $\Delta q$  or uncertainty of position occurs and if the atoms follow Bose statistics, a Bose-Einstein condensate is formed. The atoms assume the same quantum state and can overlap or be in the same place at the same time. When this happens, the atoms become indistinguishable from each other and behave as a single super atom. It is possible to see a collection of only a few thousand atoms with an unaided eye because the standard deviation of position is very large. To reliably control the PF reaction, one must supply what the patent application describes as Heisenberg Confinement Energy or super confinement of the nuclei, forcing a very small  $\Delta q$  or uncertainty in position, affecting a large  $\Delta p$  (energy). This is the first new additional term to the Hamiltonian describing how QF works.

## Non bonding energy

The term non-bonded energy is the second term added to the Hamilton describing QF. This term refers specifically to atoms that are not bonded to each other in a molecule. The non-bonded energy accounts for repulsion, van der Waals attraction, and electrostatic interactions. Van der Waals attraction occurs at short range, and rapidly dies off as the interacting atoms move apart by a few Angstroms. Repulsion occurs when the distance between interacting atoms becomes even slightly less than the sum of their contact radii. The hydrogen in the lattice is not bonded

and actually causes some deformation of the lattice on entry, indicating that it has forced entry into the portion of the equation controlled by a factor of  $1/r^{12}$ . It is the  $1/r^{12}$  effects driven by phonons. Phonons are bosons and can be in the same place at the same time, driving electron capture events. This second new term to the Hamiltonian drives the Fleischmann-Pons Effect.

## Q Energy

In Profusion Energy's work to date, both the non-bonded energy and Heisenberg Confinement energy are driven by what Profusion Energy calls Q or quantum compression energy. This is used to stimulate super confinement waves in the lattice.

The primary Q pulse delivers the bulk of its power in ~100ns achieving a peak current density of over 7 thousand amps per square mm. The polarity of the Q pulses alternate to limit the degrading effects of electromigration on both the core material lattice elements and the hydrogen in the core. The portion of Q power reported as going to the beaker is calculated as  $\frac{1}{2} * C * V^2$  \* repetition rate.  $\frac{1}{2} * C * V^2$  is the energy or joules contained in the capacitor being discharged across the wire and repetition rate is times time or the joules per second which equals Watts. A Quantum Fusion reactor uses Q waveforms to force the value of the Molecular Hamiltonian. Once the value is high enough to supply the mass energy difference between a hydrogen ion plus an electron and the mass of a neutron or neutron cluster, that energy converts to mass in an electron capture event. A large number of hypotheses have been put forward to correlate the production of tritium and helium with heat. Accusations that it could not be fusion due to the lack of Gamma rays and fast neutrons were almost instantaneous. I propose that the QF Hypothesis can account for all the Fleischmann-Pons Effect experiments and some of the other excess heat experiments such as Bubble Driven sono fusion style devices, laser activation of metal hydride systems and gas load plus heat systems. This reaction is not fusion as the current establishment defines it. The perceived reaction is not DD.

## What is Quantum Fusion (QF)?

When the system energy or molecular Hamiltonian achieves or exceeds the energy necessary to make up the mass difference between a hydrogen ion plus an electron and the mass of a neutron or neutron cluster, the hydrogen nucleus undergoes an electron capture event as a natural energy reduction mechanism. This highly endothermic reaction, in combination with the dispersion of the phonons that caused the increased confinement, results in a cold to ultra-cold neutron and/or neutron cluster. Neutrons are attracted to each other but the attraction is not strong enough to be "bound". At energy levels of a few meV (38 meV is roughly 70°F or 21°C), the Brownian motion will shake the multi neutron systems apart. However, a deuteron that has just converted up to 3 MeV of energy or a triton that has just converted up to 9.3 MeV of energy to mass has an extremely low energy level. The energy level is low enough that the neutrons remain together long enough to interact with another hydrogen nucleus moving through or into the lattice location occupied by the newly formed neutron or neutron cluster. With the removal of the proton's charge, it is possible for a new hydrogen nucleus to enter the same trapping point and bond with the neutron or neutron cluster. This is similar to concepts used in astrophysics and referred to as the S and R process that build the heavier elements inside of stars through accumulation of neutrons and  $\beta^-$  decay. In QF cold to ultra-cold neutron(s) interact with another hydrogen nucleus moving through the lattice, resulting in  $^4\text{H}$ .

Part of the problem for established physics is that their information is based on big science accelerator experiments. This led to a policy at the National Nuclear Data Center (NNDC) that defines the “ground state” of a nucleus as the “lowest energy at which it has been observed”. The first three links you are likely to run across at the NNDC in relation to  ${}^4\text{H}$  indicate that it undergoes a 100% neutron ejection decay path, even at what they have arbitrarily defined as the “ground state”. Another document, mass.mas03.txt states the mass of  ${}^4\text{H}$  as being greater than the mass of tritium + a neutron. This was referred to as an un-bound nucleus. (Meaning what?)

Researchers extrapolated the path of a neutron and a triton back to the same point. For  ${}^4\text{H}$  that time of existence is so short it is given as a width of 4 MeV. That calculates out to roughly  $10^{-24}$  seconds, more precisely 82.28 yocto-seconds after an 8 MeV neutron collides with a  ${}^7\text{Li}$  nuclei. I have discussed this with J. H. Kelly of the National Nuclear Data Center (NNDC). He assured me that this was the absolute lowest energy level at which you could possibly create  ${}^4\text{H}$ . (Does this sound like the ground state?) When  ${}^4\text{H}$  is formed as an early intermediate decay product from a high-energy collision, there is sufficient momentum to make it energetically favorable for a neutron to carry the excess energy away before  $\beta^-$  decay occurs. In a metallic lattice where low energy neutrons accumulate,  $\beta^-$  is the decay path. Papers compiled in NNDC do indicate this. (The data is somewhat difficult to access. To retrieve it, go to <http://www.nndc.bnl.gov/ensdf/>, enter  ${}^4\text{H}$  in the Quick search: box, and click “Search”. Click the check the box next to the  ${}^4\text{H}$  and click “HTML”. See the first sentence in the data sheet.)

According to Kelly, if there were some way to make  ${}^4\text{H}$  at a low enough energy ( $\leq 3.53$  MeV), then it would undergo  $\beta^-$  decay. That can't be done in an accelerator. When solid-state systems produce  ${}^4\text{He}$ , each helium nucleus formed liberates between 23.2 MeV and 27.5 MeV depending on the exact path taken.

## Gross loading

Existing attempts to harness the Fleischmann-Pons Effect depend on what I call Gross loading. By achieving a loading ratio greater than 0.85, the movement of hydrogen ions is limited by the number of open octahedral points. It also moves the lattice away from equilibrium and raises the base level result of the Hamiltonian operator. Why don't all palladium samples work once the loading ratio exceeds 0.85? Researchers have talked about the grain structure and cracking. Wave phenomenon or phonons are reflected and refracted by grain boundaries and cracks or discontinuities. The Nuclear Active Environment is one where enough phonon peaks intersect to obtain the  $1/r^{12}$  + Heisenberg confinement energy necessary to affect electron capture events. Typical gross loading problems are driven in part by the quantity of hydrogen present in the lattice when the reaction starts. The bonding energy released in the formation of helium or transmutation causes a local chain reaction release of energy that eventually destroys the mechanical structure that was supporting the reaction.

## Quantum Fusion (QF)

Quantum Fusion avoids these problems by explicitly driving the required phonons or displacement of the lattice elements. By performing this in an explicit manner, it is possible to run the reaction at a very low level and low loading ratio. At this point Profusion Energy has not yet ascertained the minimum (loading\*phonon level) necessary to run the reaction but the systems appear to begin producing excess heat as soon as they are activated. Another aspect that leads me to believe that the Fleischmann-Pons Effect is driven by rogue or super waves causing

electron capture events is the system response to Q repetition rate. As the Q repetition rate is adjusted up, the reaction has peaks and then rolls off before picking back up to a higher peak as the repetition rate continues to increase. The current hardware has a maximum Q repetition rate of 100KHz but the best results obtained are below that frequency. The patent applications show a number of different ways to build a practical reactor but systems to date have been built using wire cores and fast current pulses for the Quantum Compression.

Most of the scientific community agrees, it is not possible to overcome the coulombic repulsion of hydrogen within a metallic lattice. However as I have just outlined, it is not necessary to overcome coulombic repulsion. This is not fusion as currently defined.

The Quantum Fusion Hypothesis not only explains the reaction but points to multiple ways of making industrially useful devices by controlling the underlying physics.

## **References**

1. R. E. Godes, *The Quantum Fusion Hypothesis*, Profusion Energy Inc., September 2008  
[www.profusionenergy.com/PhaseIVerificationData/ProfusionEnergyHypothesis.pdf](http://www.profusionenergy.com/PhaseIVerificationData/ProfusionEnergyHypothesis.pdf)