QED induced cold fusion

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Introduction

On 14 January 2011, Italian scientists Andrea Rossi and Sergio Focardi at the University of Bologna described the ongoing development of a Cold Fusion reactor [1] producing 12,400 W of heat with an input of only 400 W. The patent application discloses fusion by electrically heating Ni powder under hydrogen gas. The powder is comprised of Ni particles of various shapes including nanoparticles, NPs. In operation, the device starts with about 1,000 W of electrical power, which is reduced to 400 W after a few minutes.

Rossi and Focardi admit they do not know the mechanism by which the fusion is triggered, and instead simply claim in their patent the prototype supplied with 400 W of electrical heat produces 12,400 W. Nuclear fusion and not chemical reactions are suggested, i.e., "the presence of copper and the release of energy are witnesses." Steven Krivit, publisher of the *New Energy Times*, noted that Rossi and Focardi's reactor seems similar to a nickel-hydrogen low-energy nuclear reaction (LENR) device originally developed by Piantelli. Rossi [2] claims a LENR fusion rate of about $7x10^{16}$ /s. However, Rossi and Focardi's patent for the device has been rejected and publication of a supporting paper refused by peer-reviewed journals

Purpose

To propose the Cold Fusion observed at Bologna is indeed nuclear fusion produced from the QED induced creation of photons from the electrical heating of NPs in the Ni powder.

Theory and Application

The Cold Fusion observed at Bologna is proposed caused by the QED radiation produced from the NPs in the Ni powder. QED stands for quantum electrodynamics. The QED radiation is a consequence of QM that requires the specific heat of NPs to vanish, and therefore absorbed EM energy from heating cannot be conserved by an increase in temperature. QM stands for quantum mechanics and EM for electromagnetic. Instead, absorbed EM energy in NPs is conserved by creating QED photons *inside* the NPs by frequency-up conversion to their TIR resonance. TIR stands for total internal reflection.

QED is a complex mathematical process, but the physics of creating QED photons in NPs may be easily understood by considering EM energy supplied to the *inside* of a hypothetical cubical box. If the walls provide EM confinement, QED induces the EM energy to create photons that match the geometric constraints of the box, i.e. for walls separated by L/2 the QED induces the supplied EM to create photons of wavelength L. But NPs are submicron, and therefore the frequency of the QED photons is beyond the UV and extends to SXRs. UV stands for ultraviolet and SXRs for soft x-rays. QED induced radiation from NPs is not unique to Cold Fusion, and explains [3] many unresolved problems in physics, e.g. Hubble's red-shift in cosmic dust instead of by Universe expansion, memristors as the missing fourth element in electronics, smell from odorant molecules, cancer from DNA damage in man, and others.

Application.

How Ni NPs provide the confinement of supplied EM energy may not be immediately obvious. Supplying EM energy follows from the absorption heat by NI NPs upon contact with the hot larger powder particles, the latter allowed by QM to increase in temperature from the electrical heat. Since NPs have high surface to volume ratios, the absorbed EM energy is confined by TIR almost entirely in the NP surface. Under TIR, few if any QED photons are near normal to the NP surface where they leak to the surroundings. In NPs, the TIR confinement is momentary and occurs only upon absorption of EM energy, and therefore, the TIR confinement effectively sustains itself. Moreover, as long as EM energy is supplied to the NP there is no limit to the number of QED photons that may accumulate in the NPs, and therefore the EM energy *inside* the NPs continues to increase to the 2.6 MeV/ atom level required to transmute 6.15MeV62Ni to 8.7MeV- 63Cu. The temperature of the Cold Fusion reactor increases, but provided the thermal insulation is sufficient to preclude any heat loss to the surroundings, the QED photon energy may be equated to 100 % of the electrical heat Q_{in} supplied. When the accumulated QED energy/atom reaches 2.6MeV, the Ni atoms fuse. QED photons are created in the NP with Planck energy E and frequency f,

$$E = hf \quad \text{and} \quad f = c/\lambda \quad \text{and} \quad \lambda = 2nD \tag{1}$$

where, h is Planck's constant, c the speed of light, and n and D are the NP refractive index and diameter. The absorbed EM energy Q_{in} is,

$$Q_{in} = N_a N_p E \frac{dN}{dt} \tag{2}$$

where, dN/dt is the rate of QED photons created in the reactor, N_a and N_p are the number of atoms/NP and NPs in the reactor. For Q_{in} = 400 and 1000 W, the Planck energy E and rate dN/dt are shown in Fig. 1. The numbers N_a of atoms/NP and N_p of NPs/reactor are given in Fig. 2. .

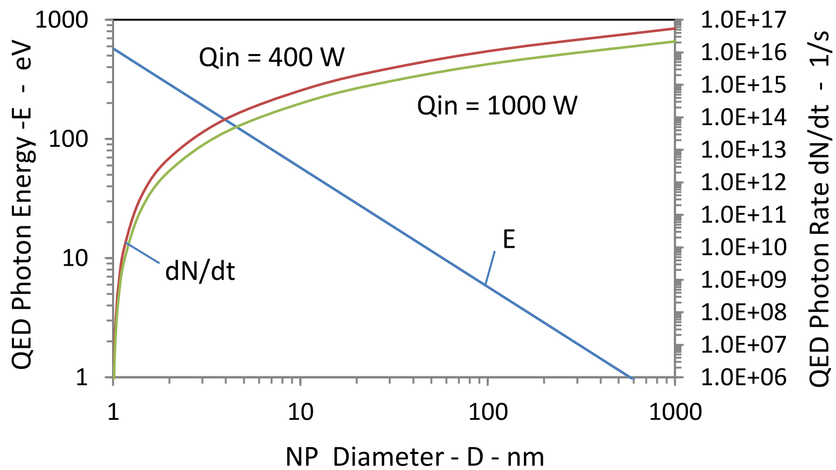

Figure 1. QED Photon energy E and rate dN/dt at 400 and 1000 W

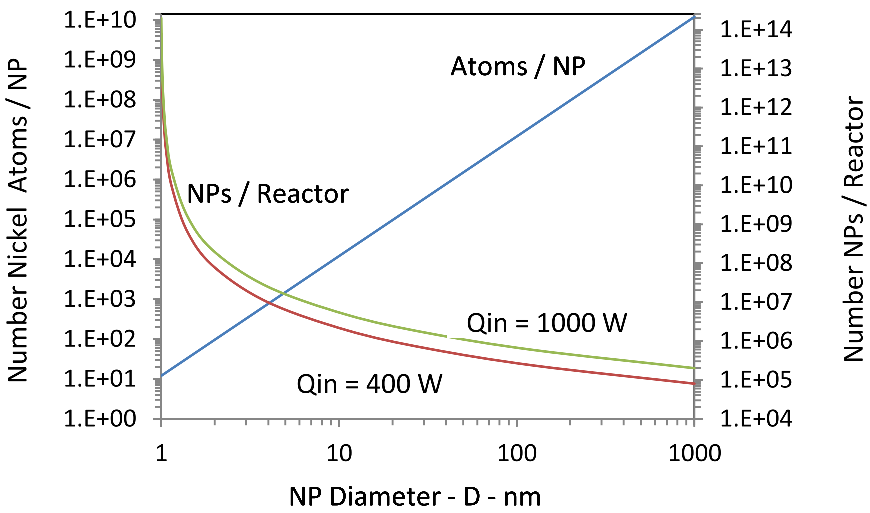

Figure 2. Number of N_a and N_p at 400 and 1000 W

Although the size distribution of NPs is required to properly evaluate the Cold Fusion reactor performance, only 5 nm Ni NPs are considered for illustrative purposes. Since Ni has n = 1.08, the QED photons have SXR energy at E = 115 eV. The total number of Ni atoms in the reactor is N_pN_a of which the Ni lattice spacing of Δ = 0.352 nm gives $N_a = \pi(D/\Delta)^3/6$ = 1500 atoms/NP. But the number N_p of NPs in the reactor is not given, and is estimated from the amount of input heat Q_{in} necessary to raise all Ni atoms to the 2.6 MeV necessary for fusion. Hence,

$$N_p = \frac{Q_{in}}{N_a \circ 2.6\text{MeV} \circ 1.6\text{x}10^{-19}} \tag{3}$$

For Q_{in} = 400 and 1000 W, $N_p = 6.4\text{x}10^{11}$ and $1.6\text{x}10^{12}$, and therefore the respective fusion reaction rate $N_a\,N_p = 9.6\text{x}10^{14}$ and $2.4\text{x}10^{15}$/s that is lower than Rossi's estimate of $7\text{x}10^{16}$ /s. The fusion energy release R / reaction is,

$$R(\text{MeV}) = \frac{Q_{out}}{N_a \circ N_p \circ 1.6\text{x}10^{-13}} \tag{4}$$

For Q_{out} = 12,400 W and the number N_p of NPs, R varies from 33 to 81 MeV/atom.

Discussion

The Cold Fusion reactor yield Q_{out}/Q_{in} from 12.4 to 31 and the energy release/fusion reaction from 33 to 81 MeV appear high suggesting that the input heat Q_{in}. may be higher than 400 or 1000 W. If Q_{in} = 3800 W, the yield Qout /Qin =3.26 and $N_p = 6.1\text{x}10^{12}$ gives $N_a\,N_p = 9.1\text{x}10^{15}$/s that is closer to the $7\text{x}10^{16}$ /s computed by Rossi. The $N_p = 6.1\text{x}10^{12}$ and the energy release R = 8.5 MeV/fusion reaction which is more reasonable because of proximity to the binding energy of 63Cu.

Conclusions

1. The Italian Cold Fusion experiment is yet another application of QED induced radiation in physics over the past century. Contrary to classical physics, QM forbids nanostructures to conserve absorbed EM energy by an increase in temperature. Instead, conservation proceeds by the creation of QED photons *inside* the nanostructure having a frequency at its TIR resonance, typically beyond the UV.

2. QM places no limit to the number of QED photons that may accumulate under the TIR confinement of NPs. Upon reaching the 2.6 MeV/atom necessary to transmute 62 Ni to 63 Cu, fusion of Ni atoms may be considered to occur.

3. LENR and catalysts have nothing to do with the observed 12,400 W output of the Italian Cold Fusion reactor. The Ni-H reactions are truly nuclear fusion, and claims of net power generation by Rossi and Focardi are valid. But like conventional nuclear fusion, the commercialization of the reactors for public use should clearly state the radiation dangers.

4. The similarity of the Black Light Power and Italian Cold Fusion reactors suggests the same QED physics should also apply. But again, radiation dangers should be included for public use

In summary, **t**he physics of QED induced fusion in NPs was presented in this paper; whereas, the nuclear physics of binding energy and energy release/fusion reaction was not. Details of the transmutation of Ni to Cu in combination with how hydrogen atoms in contact with the NP surface fuse requires far more study. Comments are appreciated. .

References

[1] http://www.physorg.com/news/2011-01-italian-scientists-cold-fusion-video.html
[2] http://www.22passi.it/downloads/LENRMain.pdf
[3] http://www.nanoqed.org, 2009-2011.