# Review of the Storms Paper

**Andrew Meulenberg***

Edmund Storms' paper, "Cold Fusion from a Chemist's Point of View," has some serious flaws, but it also has some good points.

A major flaw of the paper is its dependence on a hypothesis of "two-in-two-out." The argument is flawed and is based on physics quite different than that suggested in the paper. It is used throughout the paper and, by it being incorrect, thereby vitiates the value of the paper.

Storms writes that the "two-in-two-out" rule is "characteristic of all nuclear reactions initiated between two particles." Is this a rule in nuclear physics? It is not universal in physics and probably not so even in nuclear physics. Or, is it based on *The Science of Low Energy Nuclear Reaction*, by Storms? If so, it is an observation, not a rule.

The paper indicates that "momentum is conserved in a different way compared to hot fusion." In physics, energy and momentum can be conserved in an inelastic (fusion) collision between two equal-mass bodies with *no* extra output particles or radiation. This is a two-in-one-out event. If this does not happen in nuclear physics (ever) then it would be worth a publication (or at least a reference).

Storms seems to ignore "triggered" cold fusion. If this is the intent, then triggering should be stated explicitly as "outside" the chemical environment.

On page 4, Storms writes that the process is "unique and is proposed to be only possible as a result of a resonating structure involving hydrogen nuclei trapped in a crack of a special size." This resonance model is essentially that proposed by Schwinger ["Nuclear Energy in an Atomic Lattice," *Proc. First Annual Conference on Cold Fusion*, Salt Lake City, 1990) except that Schwinger uses phonons, not photons, and ends up at the first excited state of $^4He^*$, giving off 3.8 MeV, not at the ground state. This gives tritium production, *i.e.* hot fusion. However, at the time of Schwinger's publication the $^4He$ end product of cold fusion had not yet been confirmed. I suggest updating the Schwinger model to include a transition to the ground state, giving off the 24 MeV as phonons rather than a single photon. Thus, with both levels accessible via phonon decay (the first excited state and the ground state of $^4He$ ), Schwinger's and Storms' models both provide for negligible neutron production, low tritium production and no ~24 MeV gammas from DD fusion.

Storms claims that there is no energetic radiation in the form of n, T or 24 MeV gammas. His energy-decay mode is via double-photon decay instead. However, this ignores the possibility of screened tunneling into the fused D-D state and the natural "hot fusion" consequences of that action. He also does not seem to recognize the low transition probability of the double-photon decay relative to phonon decay in a lattice. While the double-photon decay explains some reported experimental observations, and therefore is a major contribution to the subject if confirmed, it certainly cannot be the major decay mode as Storms proclaims. A recognition and understanding of Schwinger's heretical model would give Storms' paper a physical and mathematical basis and put a Nobel Laureate's knowledge and prestige behind at least a part of his model.

Storms writes (page 5) that "a collection of $H^4$ nuclei result if the starting nuclei were deuterons (d). . ." How does the $^4H$ nucleus form from deuterons? Does the energy concentrate by resonance to ~3/4 MeV in this environment so that $p + e \rightarrow n$? More likely it would be the protons in the deuterons forming a deuteron with one of the linearly transiting electrons. Further, Storms writes: "The unstable $H^4$ immediately emits an electron to form $He^4$." This part is very weak. There needs to be a description of what the energy levels involved look like (with delta E = ~1.5 MeV) and why the radiation is paired (two-in-two-out doesn't cover this). Did Campari *et al*. (Storms, Reference 45) give any clues as to the nature of the levels and why a unique energy should result?

In the summary, three items are presented as "proven" in the paper: 1) Hot and cold fusion are completely different; 2) Each hydrogen is separated by an electron. (This is not a proper description.); 3) $^4H$ is an initial D-D product. These conclusions are probably wrong. They are certainly not adequately "proven" in the paper.

One of the paper's good points is that it provides a possible physical structure that fits much of the known information about hydrogen in metals and could be a basis for an early mathematical description provided by a prestigious physicist. The structure needs to be properly defined (it is presently flawed) and its connection to the theory should be described. This is important because the author's model goes against expected physics and, coming from a chemist, would be automatically rejected if not supported by Schwinger's paper. While the paper is "from a chemist's point of view," it should not casually dismiss known physics.

**About the Author**
Andrew Meulenberg, Jr. earned a Ph.D. in Nuclear Physics from Vanderbilt University. He spent 27 years at COMSAT Labs, responsible for predicting, monitoring, correcting and preventing space-environmental effects on communications satellites; he developed and managed the space-environment-simulation laboratory, and developed new devices and concepts for space-satellite systems. After five years as an independent aerospace consultant and five years as Principal Scientist in the Opto-Electronics Department at Draper Labs, he retired to teach and do independent research as Visiting Scientist at the Indian Institute of Science and, more recently, as Visiting Scientist and now Senior Lecturer at Universiti Sains Malaysia.

*Email: mules333@gmail.com