Dr. Giuliano Preparata presented one of the most interesting theory papers of the conference. The theory involves QFT-superradiance. Briefly stated, there may occur coherent domains within the Pd lattice in which the clouds of electrons surrounding the Pd nuclei are in coherent oscillation. Under such a condition, an itinerant deuteron would be thrown into deep potential wells. As these coherent domain wells become filled the probability of d-d fusion greatly increases. The paper shows that this probability can be increased 20 to 30 orders of magnitude. The author suggests that the F-P type of fusion is this coherent type of fusion while the Jones type of observed fusion is of the incoherent type and is observed at lower D/Pd ratios. Under conditions of coherent fusion, the energy developed must be transferred. Preparata provides some equations that relate the energy transfer into the swarms of electrons and shows that this energy transfer can be expected to occur in about 10^{-21} seconds.

Because the claims made by Preparata for his model can account for nearly all of the observed experimental evidence (including those who have not found excess heat) and because he develops his model from basic known physics, the paper is highly recommended.

THEORY-HAGELSTEIN

Peter L. Hagelstein, (MIT), "Status Report on Coherent Fusion Theory", *Proceedings of The First Annual Conference on Cold Fusion,* March 28-31, 1990, University of Utah Research Park, Salt Lake City, Utah.

ABSTRACT

Nuclear reaction which may exhibit coherent effect have been studied as a candidate explanation for cold fusion effects.

An analysis of a general class of two-step coherent reactions involving charged nucleons has been performed, and very small reaction rates are found. This result is due to the small tunneling factors associated with coulomb repulsion.

We are investigating two-step coherent reactions which begin through weak interaction mediated electron capture, which in hydrogen isotopes would produce off shell (virtual) neutrons. No coulomb repulsion occurs for virtual neutrons. Virtual neutron capture by deuterons would yield tritium, and virtual neutron capture by protons by a factor of 5000 on a per nucleon basis, and corresponds to a heat-producing reaction. The nuclear reaction energy would be coupled into the electrolysis process, with the final reaction products stationary.

We have found that the weak interaction process can in principle be superradiant in the Dicke sense. If so, then considerable acceleration of this type of coherent reaction may occur.

REPORTER'S COMMENTARY

Dr. Hagelstein presented an earlier paper [1] which has attracted considerable interest. This earlier paper was reported in *Fusion Facts* in the December 1989 issue.

In this presentation the author suggests that there can be a magnetic dipole coupling to a magnetic or an electric field. Hagelstein shows that by using the equations for a non-linear LC circuit that one can expect the following:

Heat is due to slow virtual neutrons or protons. Slow neutrons would be emitted. It may be possible to replace the electrolysis process with other voltage processes.

As one of the few theoretical papers based on the experimental evidence, Hagelstein's work is highly recommended.

[1] Dr. Peter L. Hagelstein, M.I.T., "Coherent Fusion Theory.", presented at COLD FUSION - A STATUS REPORT session in conjunction with the ASME Winter Annual Meeting held in San Francisco, CA December 12, 1989.

THEORY-CHUBB

Scott R. Chubb and Talbot A. Chubb, (NRL), *Proceedings of The First Annual Conference on Cold Fusion*, March 28-31, 1990, University of Utah Research Park, Salt Lake City, Utah.

ABSTRACT

Cooperative ionic fluctuation, which become energetically favorable in stoichiometric Pd-D when the associated lattice remains sufficiently ordered, provide a means for an entirely new form of nuclear interaction, "cold" or "solid state" fusion. As a consequence, 1) nucleons separated by macroscopic distances may interact in a nuclear fashion, 2) nuclear fusion may occur in which unfamiliar products are released, and 3) the periodic solid significantly alters the ioncity and effective electrostatic volume of each deuteron in a manner that is very different from expectation based on conventional theory associated with free space nuclear physics. In a periodic lattice, the evolution of such an ionic fluctuation, which we have named a Bose Bloch Condensate (BBC), becomes favorable as the concentrations of D and Pd become comparable because of large energy costs from lattice strain at individual lattice sites that result from coulombic