

# Quantum Mechanics on Cold Fusion

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## ABSTRACT

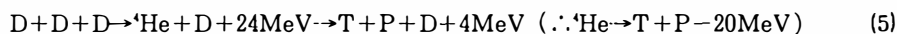
According to plasma thermonuclear fusion, the deuteron collide with target deuteron, needs high temperature thermal energy, because the deuteron change thermal energy into movement energy.

But, nuclear fusion based on the characteristic of deuteron as wave which does not need hightemperature thermal energy. because amplitude of wave cause the nuclear fusion easy. and the amplitude of wave field of deautrons resulting in tunneling effect.

Pd metal including current and deuterons appears at the crack which causing the electric field and the photon field and the deuterons field.

And wave fields of photons and deuterons interact to cause the phenomenon of superconduction.

There for incident accelerated deuteron by superconduction collide with target deuteron resulting in the nuclear fusion with tunneling effect, on this case nuclear chemistry equations are next example because of experimental value is 2.45MeV~6.MeV



## 1. Introduction

Deuterium atoms intruding into Pd metal are subject to excitation due to lattice vibration when they are packed among lattices of Pd atoms in the saturated state, which separate electrons away and become deuterons. The deuterons violently vibrate further by receiving excitation due to vibration among lattices of Pd atoms, causing cracks among Pd atoms. Thus an intense electric field appears at the

crack, according to Drude's theory, causing the photon field. If so, the field of photon as a Bose particle and that of deuteron as another Bose particle interact to give superconduction and the deuterons collide with target nucleus resulting in the nuclear fusion.

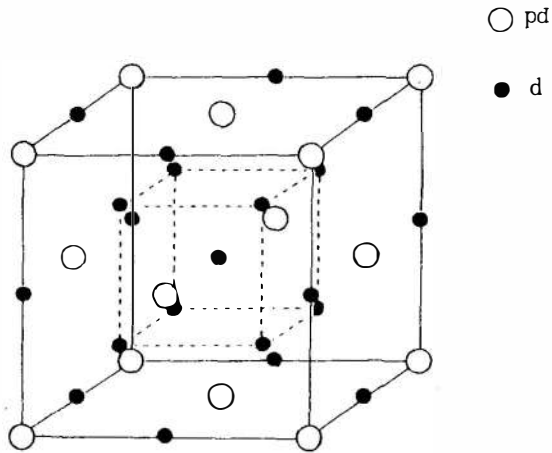


Fig. (1)

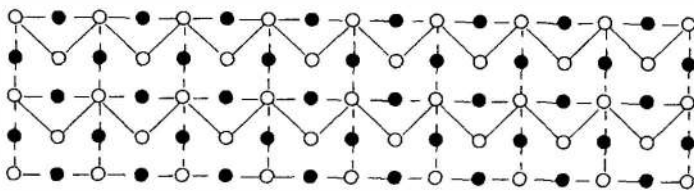


Fig. (2)

2-D model of Fig. (1)

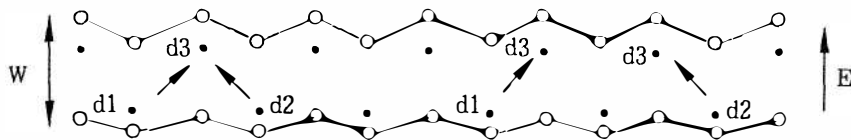


Fig. (3)

cracked model from Fig. (2)

Deuterium atoms intruding into Pd are in the state as shown in Fig. (1). Illustrated in Fig.(2) is an arbitrary section of Pd metal. Fig. (3) illustrates a state that phenomena turned from ionization to cracking,implying expansion of the Pd metal.

Electric field E created in a crack accelerates deuterons in the crack. In addition, created fields of photons and deuterons interact to cause the phenomenon of superconduction. What illustrates wave phenomenon of the field in the crack of Fig.(3) is Fig. (6), and the physical equation is

$$| c_1 \Psi_{d1} + c_2 \Psi_{d2} |^2 = | c_1 \Psi_{d1} |^2 + | c_2 \Psi_{d2} |^2 + \frac{c_1 c_2 \overline{\Psi_{d1} \Psi_{d2}} + c_1 c_2 \overline{\Psi_{d1} \Psi_{d2}}}{Z \text{ term}} \quad (1)$$

Fig. (4) expresses relationship between probability distribution and amplitude of deuterons. It is 2-body reaction for one d1, and 3-body reaction including the target nucleus for two. Fig. (5) is a wavy expression of the nuclear reaction, and it becomes a reaction of a kind of compound nucleus and the target nucleus in the cases of 3-body reaction.

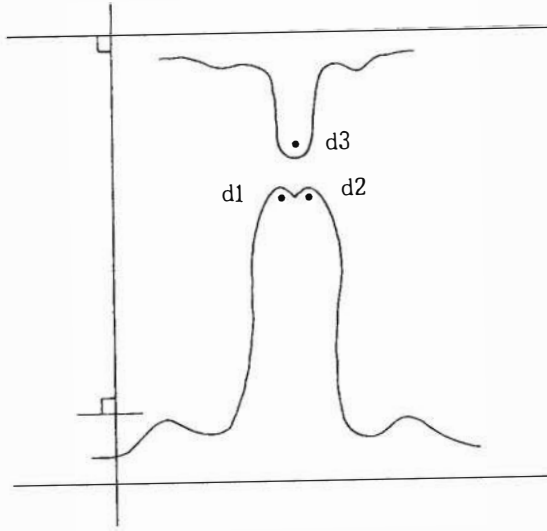


Fig. (4)

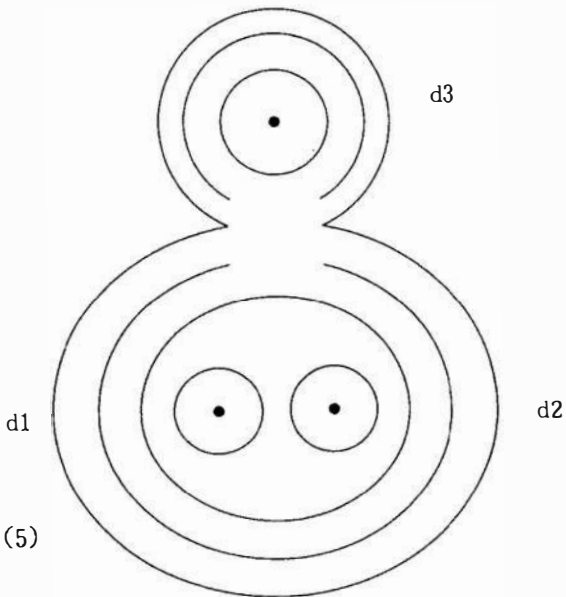


Fig. (5)

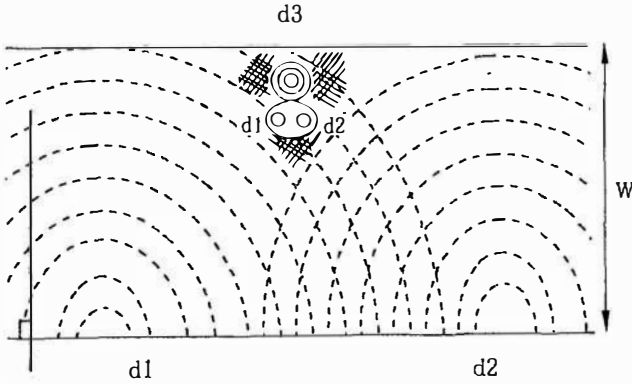


Fig. (4) , (5) and (6) illustrate nuclear fusions caused by tunneling effect due to the Z term, respectively.

Fig. (6)

With increased acceleration, superconduction and large amplitude, the target nucleus d3 and incident d particles, d1 and d2, realize the nuclear fusion through tunneling effect. Therefore, the low temperature nuclear fusion is expressed, if expanded with wave equations, as follows:

$$\begin{aligned}
 & - \left( \frac{\hbar^2}{2\mu_1} \nabla^2 + \frac{\hbar^2}{2\mu_2} \nabla^2 \right) \Psi_{2d} + (U_1 + U_2) \Psi_{2d} + w \Psi_{2d} - \left( \frac{\hbar^2}{2\mu_3} \nabla^2_{d3} + U_3 \right) \Psi_{d3} \\
 = & - \frac{\hbar^2}{2m_T} \nabla^2 \Psi_T + U \Psi_T - \frac{\hbar^2}{2m_{31e}} \nabla^2 \Psi_{31e} + U \Psi_{31e} + 9.5 \text{MeV}
 \end{aligned}$$

This  $\Psi_{2d}$  is a kind of compound nucleus state.  
3-body reaction (2)

Because of the 2 body reaction when single nucleus of d1 or d2 is located in z term,

$$\begin{aligned}
 & - \frac{\hbar^2}{2\mu_1} \nabla^2 \Psi_{2d} - \frac{\hbar^2}{2\mu_3} \nabla^2 \Psi_{d3} + U_1 \Psi_{2d} + U_3 \Psi_{d3} \\
 = & \frac{\hbar^2}{2m_n} \nabla^2 \Psi_n - \frac{\hbar^2}{2m_T} \Psi_{31e} + U \Psi_n + U \Psi_{31e} + 3.27 \text{MeV} \quad \text{2-body reaction} \quad (3) \\
 \nabla^2 = & \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}
 \end{aligned}$$

This  $\Psi_{2d}$  is an included state

This mixed theory of 2- and 3-body nuclear fusion agreed with experimental value of 2- and 3-body mixture at Osaka university.

In the crack, deuterons give rise to 4- and 5-body reactions stimulated by 2- and 3-body reactions, but if the crack becomes wider, the nuclear fusing reaction stops because electric field disappears. When the crack gets narrower by cooling, however, the nuclear fusion takes place again because the electric field reappears. If the overcurrent is caused by on-off control of current in the crack, the nuclear fusion can be promoted.

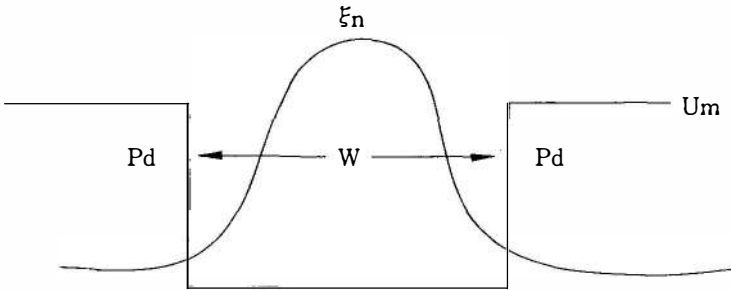
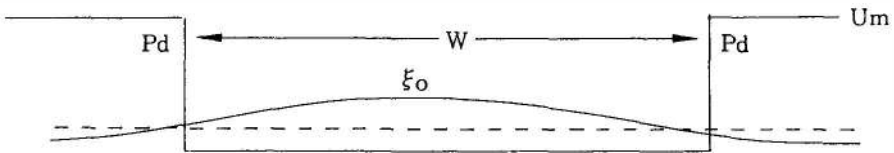


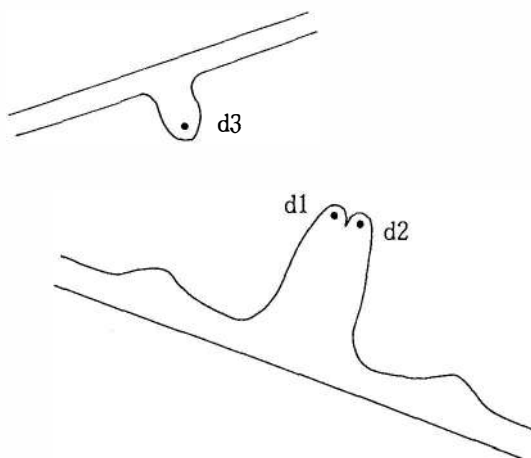
Fig. (7)

crack gets narrower.  
or  
on. off control of current.



crack becomes wider

Fig. (8)



width of crack is not Parallel lines. Fig. (9)

Cold fusion fail in Experiment sometimes, as fig (9). width of crack is Parallel lines, otherwise the compound nucleus do not collide with target nucleus. and as fig (2), deuterium atoms are Packed among lattices of Pd atoms in the saturated state, otherwise width of crack is not Parallel lines.

#### References

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