Widom-Larsen theory from TGD point of view

1. Cold fusion
   (a) Pons&Fleischman studied electrolysis. Hydrogen to a target containing deuterium at the sur-face of porous Pd catalyst. Anomalously high heat production. Not of chemical origin. Interpretation as cold fusion.
   (b) Science community did not take the observation seriously and PF were labelled swindlers.
   (c) Objections:
      i. The measurement of heat production very difficult.
      ii. Cold fusion impossible in standard nuclear physics because of Coulomb wall.
      iii. Low production rate for neutrons gammas not consistent with nuclear physics
2. Later it has been learned that
   (a) Something interesting happens.
      i. Energy is liberated (Rossi reactor) ja cold fusion is under commercialization. Also Nasa studies it.
      ii. High energy protons are produced and can be observed.
      iii. Selection rules for cold fusion not identical with those for hot fusion.
   (b) The ratios of produced isotopes are same as in Nature!
      i. Suggests that heavier isotopes are produced also outside Sun andthat this production might dominate!
      ii. Also the Lithium anomaly of cosmology suggests the same as well as reports of the occurrence of bio-fusion.
      iii. Skeptic's manner to save his world view: experimenters are swindlers adding the final products to the system.
   (c) Cold fusion could produce besides energy also metals and other elements.
3. Widom-Larsen (WL) model
   (a) Predicts correctly the isotope ratios for produced particles so that the theory must be taken seriously.
   (b) Basic step in the reaction would be governed by weak interaction. The proton of the hydrogen atom colliding with the target deuterium nucleus would transform to neuron by capturing the elecron so that Coulomb wall would disapppear and fusion reaction could occur.
   (c) Explains why gamma radiation and neutrons are produced much less than in hot fusion.
4. but has problems
   (a) p+e→n reaction is not possible for ordinary atom since the mass of electron is too small. $m_e \geq 1.3$ MeV would be needed instead of $m_e = .5$ MeV! Proposal: In the strong electric fields prevailing at the surface of the catalyst the mass of electron suffers a strong renormalization and becomes higher than 1.3 MeV.
   (b) Weak interactions are really weak. The rate for the capture reaction is extremely weak.
      i. Proposal 1: The neutron created in ecapture has extremely low energy so that the the reaction rate becomes very large (being inversely proportional to the relative velocity of neutron with respect to targed.
      ii. Proposal 2: electron capture takes place quantum coherently and re- action rate is proportional to the square N^2 of the proton number rather than N.
5. TGD model. I have proposed several models for the cold fusion. The model nearest to W-L model looks like follows.

(a) Starting point: TGD based model for dark matter as phases with large value of Planck constant: $h_{eff} = n \times h$. Compton's wave length for the particle is proportional to h_{eff}, so that the quantum size of the dark proton becomes large.

(b) Also the Compton lengths of W ja Z^0 (mediating weak interactions) λ_c are proportional to h_{eff}. Weak bosons would be effectively massless in scales below λ_c. λ_c could be even of the order of atom size for $h_{eff}/h \sim 10^7$. Weak interactions would be as strong as em interaction in this scale. Would solve problem a) if weak interactions define the basic step.

This seems to work.

(a) E-capture still impossible kinematically. Some other mechanism is needed to achieve $p \to n$. Solution: the exhange of dark W boson between proton and target nucleus transforms proton to dark neutron and Coulomb wall is avoided: $p + (A, Z) \to n + (A, Z + 1)$.

(b) The slowness of W exchange is not a problem anymore since W is effectively massless in the atomic scale. Reaction could also occur quantum coherently.

(c) Why neutrons and gammas are not observed?

   i. Gammas: Gammas are massless and correspond to much longer wavelength that otherwise: $E = h_{eff}/\lambda$. Photons do not interact with visible matter unless they are first transformed to ordinary gammas. This process is slow (also biophotons would result in this kind of process).

   ii. Neutrons: Dark phase absorbes dark neutrons just likein W-L model. Interaction cross section is proportional to h_{eff}^2 ja very large. Large h_{eff} in TGD model corresponds to very low energy in WL model. This mechanism could be at work also in the absorption of dark gammas. This would explain partially the heating.