Conservation of Energy and Momentum, a Cavitation Heat Event

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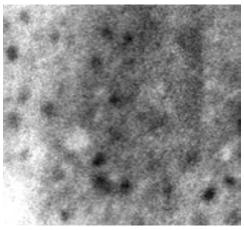
The natural acoustic cavitation bubble process has a destructive end [1], but empowers deuteron cluster implantations into target foils. A cluster of 100 transient high-density deuterons is squeezed first into a condensate cluster. Two (α) of the 100 deuterons are further squeezed to produce one α. The high density compression process is over in a picosecond. The products are He^4 and Δmc^2 which are distributed as heat, Qx, in the D_2O circulation. No long-range radiation products have been found during numerous experiments over a period of 2 decades. The experiments have progressed from 5Kg resonators at KHz to 20 gm resonators at a MHz. Collectively the experiments are pointing to the use of higher resonator frequencies, improving economics, durability, and Qx. The down-sizing of the acoustic resonators as the frequencies are increased show the way to better Qx resonators.

A resonator of a favourable geometry is driven by a MHz piezo in circulating D_2O that focuses z-pinch plasma jets to implant a lattice target with electrons and deuterons. The transient charge separation of the implanted mobile electrons and the relatively static deuterons through their permittivity differences produce attractive image forces [2] across an interface of deuterons and Cooper Pairs, CP, in dense condensates [3]. The transient spherical concentric condensates have additive electric fields and subtractive magnetic fields. The rapid focused squeeze of deuterons towards their shared centre of mass produces concentric condensates of deuterons and Cooper Pairs within the target foil lattice.



The energy of 20 ±10 MeV for one of 31 single events is expressed as a 50 nm diameter crater. The condensate cluster ejecta sites on the Pd foil target surface of a 10^{-12} m^2 area are shown in the FE SEM photo, to the left. The momentum and energy of this 2 particle heat event, evolves around the <u>centre of mass of a remnant deuteron condensate</u> that moves opposite to its <u>α.</u> The particle's relative masses are 98 deuterons and one He^{4++}. The opposing velocities for the 2 particles' total momentum is 0 for the one event. The kinetic energy is $\Delta mc^2=3.8\times10^{-12}$J/event. The calculated velocities for a single event 4.33×10^7 and 8.77×10^5 m/s give the split for energy removal into the D_2O. The number of events collectively, $10^{13}s^{-1}$, are easily accommodated by the survey count of the figure. A D_2O flow-through type calorimeter determined ΔT, gives the total heat-out in watts, Qo. Qx is determined from Qo-Qa. Qa is the measured acoustic input. A series of experiments controlled by the Qa input, maximum Qa of 15 watts, produced 43 watts of Qx.

These MHz experiments were done in a black box so the cavitation sonoluminescence, SL, could be monitored. The oscilloscope measurements of the Qa variable inputs from 1 to 15 watts at a MHz in a collection of 10 data points shows a relationship between SL, Qa, and ΔT, where 4.184 ΔT = Qo and Qo-Qa=Qx, in a linear relationship. SL serves as a tool for monitoring Qx. In the cylindrical resonator measurement of SL by Hamamatsu MPPCs showed that the acoustic SL emission was only 100 ns/cycle in a MHz acoustic input. It leads to a very short activity zone for the z-pinch jets/cycle that implants the target foil only during the multi-bubble SL emission pulse [1]. A natural dispersion of bubbles from a resonator for the multi bubble systems is in 100ns in a MHz. By increasing the frequency to 10 or 20 MHz, the resonators may eliminate the over 90% no bubble activity zone with overlapping SL emission peaks [1] increasing the Qx out-put about ten fold. Scales to 400 watts for a 50 gm resonator.

[1] R. S. Stringham, "Sonofusion's transient condensate clusters," Proc. ICCF-17, S. Korea, to be published, 2012.
[2] N. M. Lawandy, "Interaction of charged particles on surfaces," Appl. Phy. Lett., 95, 234101-1-3, 2009.
[3] M. Grether, et al, "Intriguing role of hole-Cooper pairs in superconductors and superfluids," Int. J. of Mod. Phy. 22, 4367-4378, 2008.