

SONOLUMINESCENCE AND SONOFUSION - HOW AND WHY

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To my dear wife, Velma, with all my love, gratitude, and devotion



OPENING STATEMENT

I have taken up the cause and am devoting myself to an alternative energy source, namely, D+D sonofusion. To that end, I have filed a patent application in 5 countries [1][2][3][4][5] which if granted would be assigned to those governments. However, as of this writing, both the USA and Canada have rejected my applications citing prior claims. Their supposed prior claims cites do not look a thing like my claims, yet, their rejection. It is my understanding, USPTO patent examiners are required, by unpublished internal house rules, to reject 46% of all applications. So, they can not possibly allow my bubble sonofusion claims over their prior claims cited. And, their ignorance of the many types of sonofusion also played its role.

Everyone on this planet is aware of the energy crisis with its variable costs effecting everyone and their economies. If fossil and bio fuels remain our principal energy supplies, continued Human experience as we know it, may not exist in the near future because we could then no longer afford the high costs of, and rely upon, a readily available stable ample supply of energy.

Therefore, before it is too late, we must depend upon acceleration of putting in place alternative energy sources such as wind, solar, nuclear, etc., to replace depleting fossil and bio fuel energies. Renewable bio fuels such as corn and sugar-cane ethanol are stop-gap at best. Ethanol production does cause an increase in costs of those certain foods. Switching to other bios is still stop-gap.

Energy producers around the planet are saying in effect, "We own the energy you want but you

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must pay our price we set.”; and, “Any price we set is reasonable according to private sector markets our friends control.”

That is why I encourage all governments to stand firm and keep rights, patents, and copyrights on sonofusion in the public sector for as long as it takes for money mad crooks in the private sector to die off. Governments in the meantime can pay off their debts with fusion and put millions back to work. Government laboratories can update sonofusion as required to maintain patents current.

Rapid deployment of alternative energy replacements of fossil and bio fuel energies will tend to stabilize our atmosphere's CO₂, eventually to lower its percentile. Deserts and rolling hills will bloom from purified and pumped sea water resulting in plant life consumption of CO₂.

At this time in our history of do-nothings, most politicians and nearly all bureaucrats take a hands-off approach to any potential solution of the energy crisis. This serves to worsen the crisis. I label such persons as marauders of diverse flow of funds, taking criminal-like advantage to enlarge their super-egos and super-sized résumés.

PREFACE

History of bubbles in liquids producing energy goes back to the days of 1920s and 1930s when sonoluminescence was discovered and re-discovered over and over again.

This paper is largely based upon my liquid D₂O sonofusion reactor [1]. In order for a sonofusion reactor to be successful, it must continuously produce power output not merely for a short burst of power then shut down to refuel or clean-up. A cubic meter reactor of my design should produce 100KW of electricity continuously. However, periodic routine maintenance would be required and certified by an expert. Much training would be needed to become an expert. I look forward to the feds establishing a training prerequisite to granting sonofusion technician licenses.

INTRODUCTION

It is a study of collapsing bubble radii in terms of chaotic internal heat patterns and thereby chaotic infra-red radiation which leads to more logical concepts of how and why does a collapsing acoustical bubble give rise to its internal collapsing concentric shock-wave [6] bubble partner then on to the sonoluminescence [7] occurrence, and on to concepts of D+D sonofusion [1].

To form in the acoustical field in absolutely 100% pure liquid D₂O of my reactor, a bubble must form around a starting point, be it an electron, an ion of OD, D, or O. When enough D₂O vapor molecules have clustered as a vapor bubble around the ion beyond a threshold, that bubble's destiny is then controlled by the reaction gap energy cycle.

Some have suggested a bubble of water vapor would not collapse in the presence of an acoustical field because the vapor would condense and the bubble would thus disintegrate. This avoids the extremely rapid increase in internal temperature and pressure due to absorption of very strong re-

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action gap energies to a temperature well beyond D2O boiling. The hottest part of the acoustical bubble is just inside its surface. This is the logical reason for a bubble to first expand because its temperature and pressure are in sync with the acoustical cycle. Then later down the cycle, its hottest part causes the bubble to collapse, still in sync with the acoustical cycle.

A minds-eye view of a collapsing D2O acoustical bubble, then its inner concentric shock-wave bubble formation, would show they both contain chaotic internal heat patterns changing extremely erratic as bubble radii reduction occurs. These concentric D2O bubbles contain multitudes of these erratic patterns which these events appear to account for certain observed bubble effects such as a corrugated acoustical bubble surface [8].

Bubble fusion has been in the works for a long time with many patents granted here and there over time [9]. As I see it, the problem of bringing bubble fusion into society's usage has to do primarily with the many continuous wars of words over who discovered what, when. And, whether discoveries were real, or fraud, or merely a mix-up in paper work.

DSO OF DARPA OF DOD SONOFUSION RESEARCH FUNDS AT AN END

More than \$800,000 was spent by DARPA in contracts let to verify sonofusion but the program was ended without verification. Here is the email reply from DSO Sonofusion Program Director William Coblenz on 11/12/08 in answer to my email suggestion of including my reactor design in his Sonofusion Verification Program:

Dear Mr. Fitzgerald,

I would like to acknowledge receipt of your e-mail concerning Sonofusion. The DARPA Sonofusion had as its goal the independent verification of the claims made of acoustic cavitation induced inertial confinement fusion. The program ended without verification of the fusion claims and I would not expect the Agency to fund similar work in the future.

Thank you for your interest in DARPA programs.

Sincerely,

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Those who made the decision to pull the funds for a Sonofusion Program ought to be replaced with persons not so inclined. We need to start using alternative energies now not 2050. We may not so much as make it to 2015 without collapse of our economies.

HOWS AND WHYS OF BUBBLE SONOLUMINESCENCE AND SONOFUSION

In the type of bubble fusion reactor I applied for a patent, transmitted into its reaction gap are certain cycling powerful energies which cause reaction gap D2O vapor bubbles to cycle their radii in sync with those cycling reaction gap energies. Vapor bubbles at first form around naturally formed ions in the D2O which then expand due to absorbed energy from reaction gap energies. The reaction gap consists of 100% absolutely pure liquid D2O between a pair of closely spaced parallel transducers [1]. Any contaminates whatsoever result in serious problems.

That portion of the adiabatic [non-linear] radii reduction cycle we are most interested in is known as the "collapse". Regardless of size of the bubble, the reaction gap cycling energies add their energies to the bubble even if the bubble internal temperature, averaged over a short period, vastly exceeds that of the liquid D2O in the reaction gap. We are not concerned with bubble average temperatures but rather the instantaneous temperature and pressure in the various chaotic pockets of peak energies and voids inside the acoustical bubble and its concentric inner partner the shock-wave bubble. The reaction gap cycling energies add to those chaotic voids in the bubble in such a fill-in-void manner as the effect is one resulting to calm chaos particularly if the reaction gap energies are properly phased.

This calming effect is a partial explanation of the maintenance of sphericalness of the bubbles during the goings on before and after a sonoluminescence burst of a broad spectrum of radiated light peaking in the ultra-violet. Then later all the way down the collapse cycle to a point just before where D+D sonofusion first takes place.

At a certain point on the acoustical bubble collapse cycle, occurs production of a faster collapsing supersonic shock-wave bubble inside and concentric with the slower collapsing subsonic acoustical bubble.

We can see how and why this shock-wave bubble forms. Supposing we were to mind's eye examine concentric spherical layers of gases outwards from their common center, we would see a change in the dielectric constant increasing from one layer to the next from the center outwards to the acoustical bubble surface. A higher dielectric constant allows a greater transfer of energies from the reaction gap to a given layer over that of the next smaller layer. This results in a higher temperature and pressure with each larger layer. The effect is at a certain point of bubble collapse, the surface layer of the acoustical bubble contains sufficient energy over the next smaller layer to launch towards the center a supersonic shock-wave bubble. It can not launch outward because the liquid D2O has a larger dielectric constant than does the layers inside the acoustical bubble's surface layer and it would have to launch through the acoustical bubble's surface tension strong enough to prevent launch outward.

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In addition, that initial production of the shock-wave bubble occurs during partial ionization during rapid rise in temperatures and pressures of the various layers. Then further on occurs a short burst of sonoluminescence caused largely by huge variations in heat content and infra-red patterns with pockets of high and void energies throughout the gases of both bubbles with absorption thereby of reaction gap energies into the pockets of void energies which causes erratic ionization, de-ionization and re-ionization. That chaotic ionization, de-ionization and re-ionization beyond a threshold gives rise to sonoluminescence. Thereafter the bubbles, both acoustical and shock-wave, remain fully ionized and then stabilize in sphericalness, from absorption of reaction gap energies, until the shock-wave bubble goes on to the beginning first stage of three sequential stages of D+D fusion.

The electrons freed by full ionization of both the acoustical and shock-wave bubbles in effect migrate outward as the concentric bubble spheres continue to collapse. The electrons all eventually wind up in a negative charge sphere just outside the surface tension sphere of the acoustical bubble sphere and held there by the internal positive charge of both volumes of concentric acoustical and shock-wave spheres. This allows both acoustical and shock-wave bubbles to stabilize in sphericalness yet does not prevent formation of tiny chaotic pockets of high and low energies.

The collapsing shock-wave bubble has a number of features. Leading edge is at a lower temperature and lower pressure than the trailing edge. Suggesting the trailing edge is able to absorb more of the energies from the reaction gap than the leading edge, giving rise to faster collapse. Changes in radii of the concentric bubbles are adiabatic [non-linearity] allowing for certain aspects of the reaction gap energies to be absorbed more readily as a result of adiabatic changes in the dielectric constant mainly of the shock-wave bubble as from its leading edge higher to its trailing edge and versus phase angle of the collapsing cycle.

Also, at another certain point further down on the collapse cycle, the concentric bubbles now are somewhat spherically stabilized via their absorption of properly phased energies from the reaction gap. This is as a result of a calming down of the chaotic ionization, deionization, and reionization which occurred during sonoluminescence into mostly ionization yet chaos of energy pockets remains. As mentioned above the freed electrons have, in effect, migrated to form a shell around the outside of the acoustical sphere. This aids the acoustical bubble's sphericalness.

And, at yet another certain point, the much faster collapsing tiny shock-wave bubble now contains just enough concentrated chaotic energy in peak energy pockets during peaks of chaos to produce, in a short lived first stage of D+D fusion process, what is known as Selective Resonant Tunneling thru the Coulomb Barrier [10] of and between one, or other, pairs of deuterium nuclei. Selective Resonant Tunneling in that first stage occurs at a much lower energy level than is required for massive D+D fusion.

Once the tunneling inside the collapsing shock-wave bubble has produced one or more Alpha particles in a peak energy pocket, the remainder of the shock-wave bubble's internal deuterium nuclei are now energy enriched enough thru Alpha particle collisions, moderation of pockets of chaotic energy voids by oxygen nuclei energy with additional accumulation of absorbed reaction

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gap energies plus shock-wave bubble collapse energy, to the point of a short lived second stage of D+D fusion.

In that second stage of D+D fusion, Alpha particle energies contribute enough impacts with the contained deuterium to initiate full fusion inside the shock-wave bubble while the acoustical bubble's deuterium nuclei outside of the shock-wave bubble now become exposed to an exploding reverse direction shock-wave bubble plus bombardment by Alpha particles emanating from inside the shock-wave bubble's nuclear fusion exploding volume in addition to continued absorbed reaction gap energies.

The collapsing acoustical bubble is now compressed from inside and has absorbed just enough energy to initiate a longer lived third stage D+D fusion explosion this time of the acoustical bubble's entire population of deuterium nuclei enhancing the radiating explosive shock-wave bubble as it grows in radius aided by the shock-wave's internal D+D fusion explosion.

The liquid D2O acts to moderate the shock-wave and fusion explosion. The oxygen nuclei throughout these three stages of D+D fusion act as moderator giving rise to ability of the expanding shock-wave bubble to impact the transducers without damage. Synchronized impacts of many such bubble's expanding shock-waves upon transducer plates produces electricity. This impact synchronization gives justification for a very narrow reaction gap between the pairs of transducers and for very large concentration of reaction gap energies of very high amplitudes. My reactor design calls for filtering out the Oxygen and any other impurities in the otherwise pure D2O.

NOTE: A fusion reactor is no toy. If you experiment—be extremely careful to plan for the “**memory problem**” mentioned in my patent application [1]. Once the reactor has started, it has the inherent ability to go to full power regardless of load conditions. That is why I included certain electronics in my patent application to control phase angles as between reaction gap energies themselves and the collapse phase angle.

It is my hope, the new Administration, in 2009, will see to it, an ARPA-E Sonofusion Program gets funding. ARPA-E is now under DOE without funding. DARPA is under DOD. DARPA is partly responsible for creation of the Internet. It would have been a good place for sonofusion.

Dr. Steven Chu has been selected as designee for Secretary of DOE in the new Administration. An exceptionally wise and competent choice. I hope he accepts the nomination and commands approval from Congress. I can think of no better person. Nobel Laureate in Physics 1997 "for development of methods to cool and trap atoms with laser light", Dr. Steven Chu was awarded 1/3 of the Nobel Prize while he was at Stanford University.

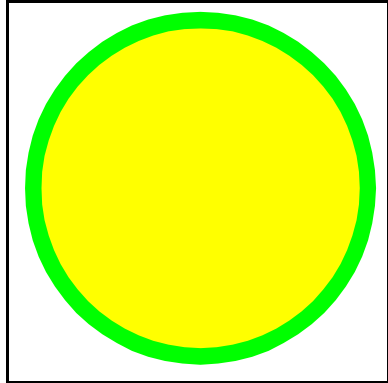


nobelprize.org/nobel_prizes/physics/laureates/ [click on 1997]

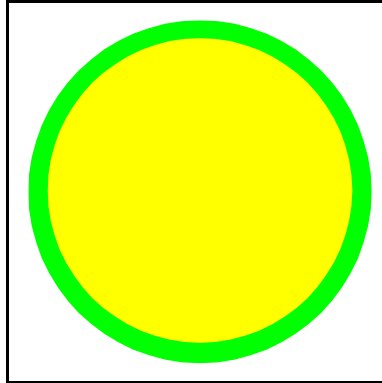
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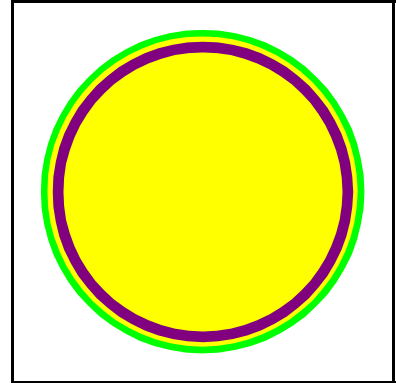
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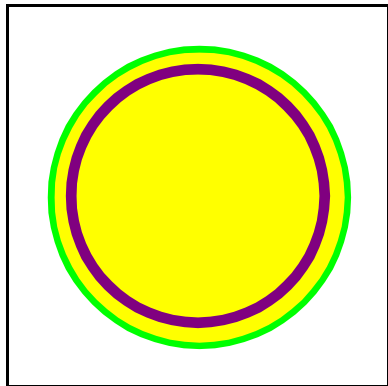
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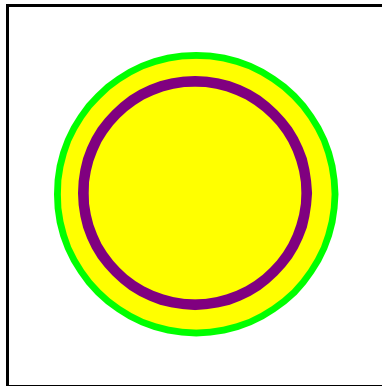
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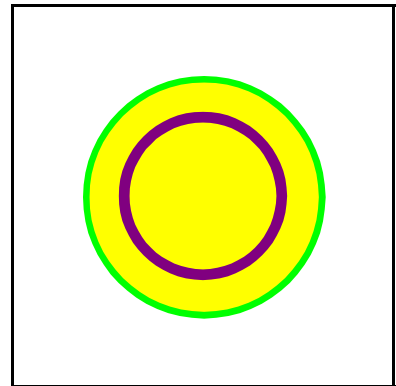
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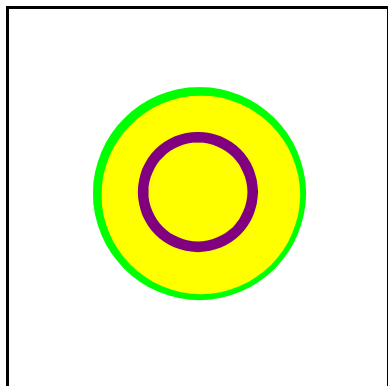
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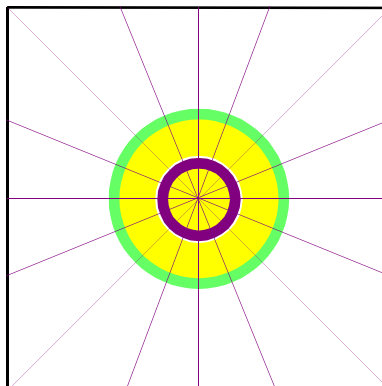
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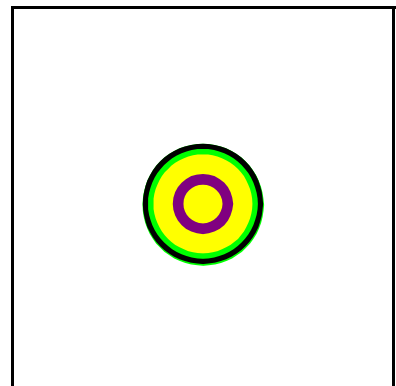
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FRAME 7



FRAME 8

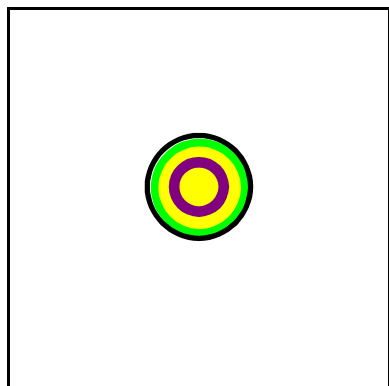


FRAME 9

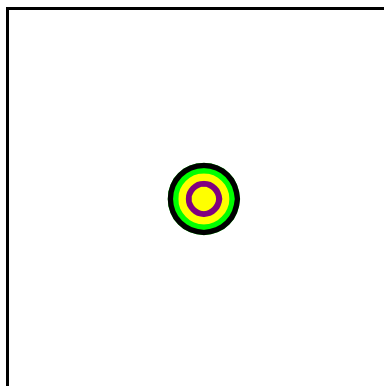
Not To Scale

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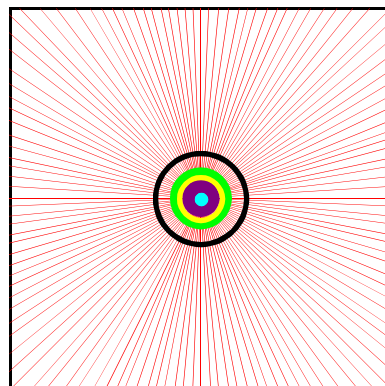
Mind's Eye Snap-shots Of A Collapsing D2O Acoustical Bubble And Its Internal Concentric Shock-wave Bubble



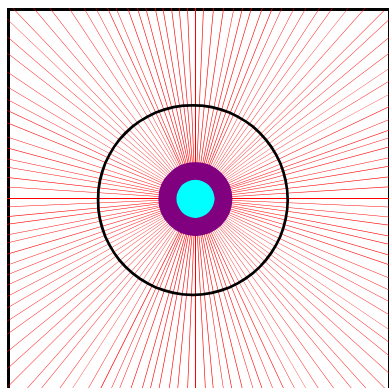
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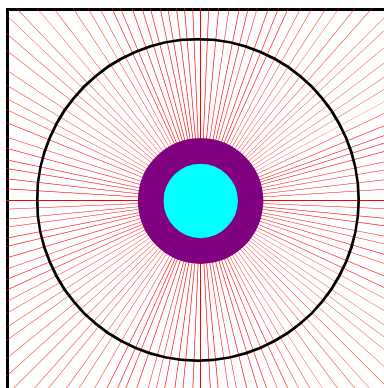
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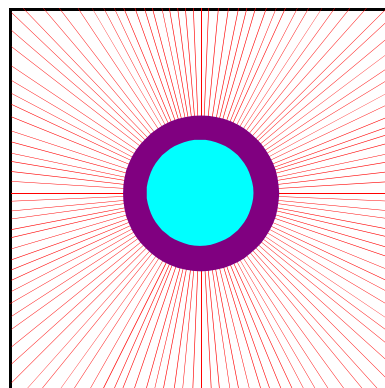
FRAME 12



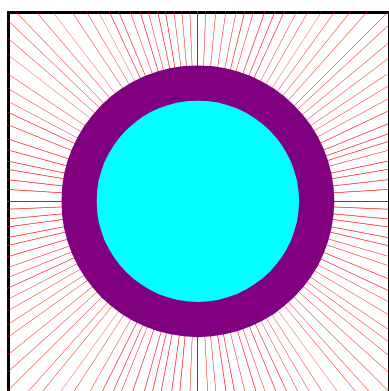
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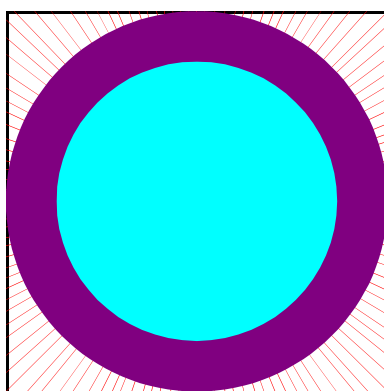
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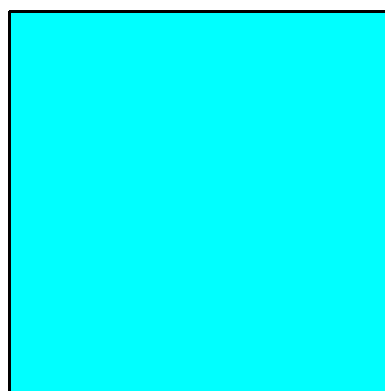
FRAME 15



FRAME 16



FRAME 17



FRAME 18

Not To Scale

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Description of Mind's Eye Snap-shots of a Collapsing D2O Bubble

Chaos, heat, temperature, pressure, infra-red radiation, and extreme erratic behavior are actually present in sono-bubble collapse but are not fully represented in these Frames due to the difficulty of drawing them so as to make any sense. These Frames only display major concepts.

Acoustical bubble surface corrugation is kept to a minimum via two primary energies in the reaction gap instead of one [1]. Absorption of these reaction gap energies by the concentric acoustic and shock-wave bubbles causes them to remain spherically stabilized before and after sonoluminescence and before sonofusion.

Frames 1 and 2 are snap-shots of acoustic bubble collapse at points much further down from the maximum bubble radius which is much larger. Green represents the bubble surface less corrugation. Yellow represents the volume of gases inside of the acoustic bubble and inside of the shock-wave bubble in subsequent Frames. Pockets of high energy and voids are not shown.

Frame 3 is a snap-shot of creation of an imploding concentric shock-wave bubble inside the collapsing acoustic bubble. Purple represents the shock-wave bubble surface either imploding or exploding in this series of Frames. Thickness of the surface of the collapsing acoustical bubble now shows thinner to represent having given some of its energy to the concentric imploding shock-wave bubble surface.

Frames 4,5, 6, and 7 show the pace of concentric bubbles' collapse.

Frame 8 shows a drastic change caused by extreme shock-wave bubble internal chaos coming to a threshold resulting in intense erratic ionization, deionization, and re-ionization in a state of total chaotic turmoil. Within the concentric bubbles are happenings of great magnitude. Temperature and pressure are in extreme flux with tremendous variations in peaks and voids concentration of energy. Some tiny pockets have high energy while others have very low energy forming energy void pockets. Ionization takes place in pockets of high energy concentration and deionization takes place in pockets of low energy concentration. The resulting external observation is a broad spectrum of a short burst of light, peaking in the ultra-violet, known as sonoluminescence. This radiation is illustrated in violet lines.

Frames 9, 10, and 11 again show the pace of concentric bubbles' collapse. But this time total ionization has stabilized in the gases of both bubbles which in effect adds to ability of the reaction gap energies to stabilize the sphericalness of both concentric bubbles. Sphericalness of the bubbles is one of the controlling factors which permits sonofusion further down the collapse. Frames 8-14 show the electron shell in black.

Frame 12 shows again a drastic change caused again by extreme internal chaos coming to another threshold only this time the temperature and pressure are very much higher and are in such a condition as to give rise to eddy pockets of very high energy. Enough so as to allow Selective Resonant Tunneling [5] through the Coulomb Barrier to take place as the first eddy pocket

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reaches that critical peak energy stage sufficient for the phenomenon of tunneling to take place. The result is D+D fusion into an Alpha particle. Oxygen nuclei act as moderator of Alpha particle impacts raising the over-all energy level of the deuterium inside the shock-wave bubble. Therein, more Alpha particles set off further D+D fusions in sort of a chain reaction. The blue dot at the center of Frame 12 is that first sign of burst of sonofusion. The imploding shock-wave is now replaced by an exploding shock-wave followed by a complete fusion of the remaining deuterium inside the collapsing acoustical bubble which now becomes totally engulfed in the nuclear fusion explosion.

Frames 12-17 show infra-red and Alpha radiation in red lines.

Frames 12-14 show the electron shell in black being dissipated outward due to the intense infra-red and Alpha radiation from the nuclear explosion of the second fusion stage and further acceleration from the explosion of the third fusion stage.

Frames 13-17 show the exploding shock-wave in purple with the sonofusion explosion shown in blue. Frame 18 shows the end of that bubble. All one sees at that point is the explosion left-over in blue.

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