Dawning of the SunCell®

Part 3 of a Series Investigating the Work of Randell Mills

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See Part 1, published in Issue 130: http://infinite-energy.com/iemagazine/issue130/WallIE130.pdf
See Part 2, published in Issue 131: http://www.infinite-energy.com/iemagazine/issue131/WallIE131Part2.pdf

On August 31, 2018, Brilliant Light Power, Inc. (BrLP) published to Youtube a much anticipated demonstration of the operation of a closed cell. The video[1] is quite brief and shows two such brilliant surges of plasma erupting from the intersection of two liquid metal electrode streams. (See Figure 1.) The streams have a small voltage difference between them. This is clearly of the type that has been repeatedly demonstrated for years, starting with glove box demonstrations.

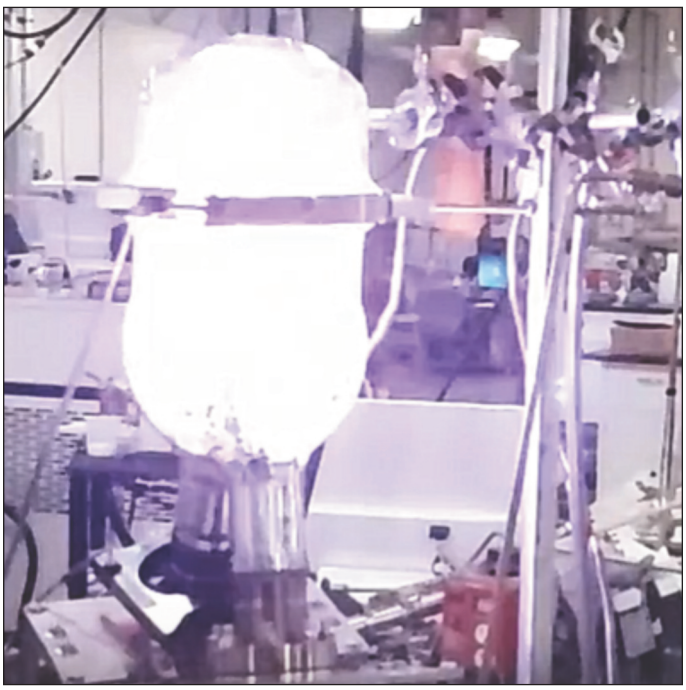

Figure 1. From the August 31 BrLP demonstration.

The reactors contain argon gas, at slightly above atmospheric pressure, so we know that outside gasses are not leaking into it. In addition, there is a small amount of hydrogen in the vessel and a trace of oxygen within the stream of liquid gallium, the metal used for the electrodes. The reactor voltage is very low. In the glass vessels, you can see when it runs out of hydrogen, as the electrodes sputter and shoot streaks of hot metal.

So, that is what we could expect, if there was ordinary chemistry at work, sputtering sparks. Combustion of oxygen with hydrogen, in such tiny quantity, would produce negligible reaction. Instead, we see a bursting of hydrino plasma that would have destroyed the Pyrex, if the reaction was not stopped in a few seconds.

I take Dr. Mills at his word, that the chemical components within the vessel are limited to argon, a trace amount of hydrogen, the gallium electrodes and some small amount of oxygen within the gallium. This mixture would not produce the energy release observed, prosaically.

An Imagination Station video[2] shows an experiment where an observer holds a significant quantity of oxygen and hydrogen in her hands while it detonates, producing no pain. Is that reaction going to shatter a Pyrex container or melt stainless steel?

On September 5, another video[3] was released. It is very dark because it is filmed at 2000 frames per second and played at 30 fps. This is a Pyrex vessel, and we can see the igniting spark from the gallium and the resulting plasma, clearly showing two separate reaction types. The limited inventory of hydrogen gets exhausted in the cloud of brilliant plasma, and finally, there are only the ignition sparks. By conventional chemistry, there is nothing much combustible to react to create the large brilliant cloud, so there should only be a spark and no cloud of plasma. That cloud is hydrino formation. (See Figure 2.)

Figure 2. From the September 5 BrLP demonstration.

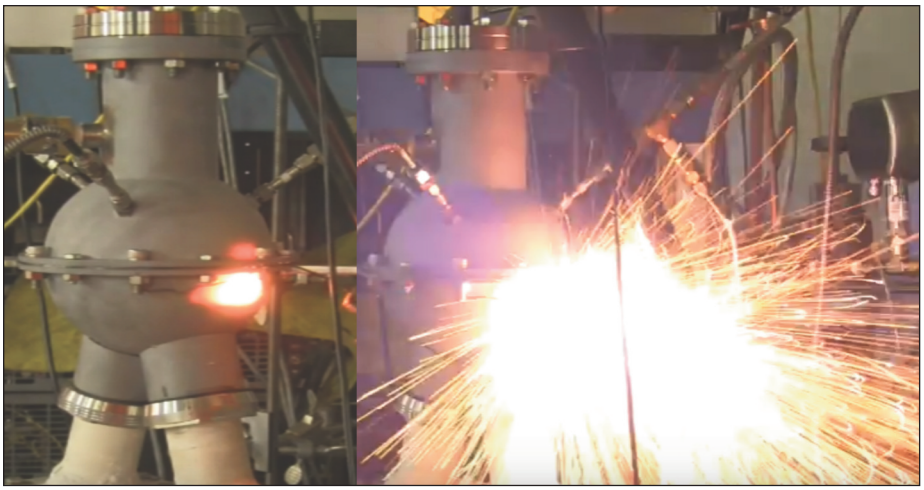

Figure 3. From the September 19 BrLP demonstration.

Then, on September 19, another configuration,[4] this time with a stainless steel vessel, coated with ceramic. (See Figure 3.) The vessel was breached about five seconds after ignition. Quoting the video description: "The SunCell reactor was at 30°C when the reaction was initiated."

When I used to think of plasma, I would think of a very high voltage, enough to ionize a path between electrodes, causing a thunderous spark, a miniature lightning bolt, to appear, then vanish. Sure, I could create a persistent arc, even under water, but it always required a high voltage. I had never considered the idea of using a low voltage, and the thought would never cross my mind. A low voltage will not cross a gap, so the electrodes must be touching. High current discharge is welding, and why would I wish to weld electrodes together?

It so happens that the conditions created on an atomic scale by low voltage and high current are quite different than those created by high voltage and low current. To ionize an atom typically requires voltage, and so ionization energies (amount of energy required to force an electron to depart from an atom, measured in eV, electron-Volts) is overcome. An eV is not the same physical thing (dimension) as a Volt, but it is a similar concept. An eV is a measure of energy, expressed as the kinetic energy of an electron after it has been accelerated through a potential of 1 Volt. So, what is a Volt? A Volt is a potential difference between two points on a conductor that will impart a Joule of energy to a Coulomb of charge, passing between those points. It has units of potential energy divided by charge. It is useful to me to think of voltage as a difference in the density of charge carriers at different places on a conductor. Those charge carriers (electrons, typically) "want" to spread themselves out as evenly as possible, and they drive energetic processes to even out their density. A conductor is that which allows electrons to reach equilibrium, to drive voltage difference to zero.

Anyway, to strip an electron from a metal (an element that "gladly" surrenders electrons), a voltage is applied across an open space. If the voltage is low, only a very small amount of electrons will leap from one electrode to another. As the voltage increases, the current increases, but not how one might expect. (See Figure 4.)

This is across a vacuum space between the electrodes, an idealized representation. An example of dark discharge is the flow of charge carriers in outer space. A glow discharge example is a fluorescent lamp.

When we examine how current and voltage are related for a conducting path that consists of simple resistance, the line tends to be monotonic, with a positive slope, starting at the lower left and going to the upper right. The resistance is positive. Remember Ohm's Law. Resistance is the ratio of voltage to current, which is the slope of our line, at any point. We see in Figure 4 two areas where the slope is negative, areas of negative resistance. The current (both free electrons and anions) increases with a decrease of voltage, which is counterintuitive, and might cause us to rethink our definition of voltage—not that it is wrong, but there is more to this path of flow than simple resistance, and differences of charge density in different places. The resistance (or more generally, impedance) is dynamic. It is nonlinear with respect to current. The channel exhibits reactive properties of capacitance and inductance. It is this dynamic that allowed vacuum tubes to be used as current switches and amplifiers of signals. Understanding what is happening within the vacuum tube formed the foundation of a great deal of what is known about atomic physics.

For purposes of gaining some insight into the SunCell, we pay attention to the region of arc discharge, specifically the region where impedance is negative, between I and J (Figure 4). This is where the cell operates (although the cell is not a vacuum), where current increases as voltage decreases, more specifically, slightly to the left of J, with minimal voltage. The line is dashed in the area where the reaction can occur, but where it is not stable, due to the extreme negative resistance. The voltage is low because the conductor has very low resistance, being silver or gallium, with a fairly large cross-sectional area, enough to conduct many thousands of Amps. Voltage is minimized, yet current flow is massive. This is an area perhaps mostly explored by welding engineers, who do not want to have hydrogen get near the metal, and certainly not water.

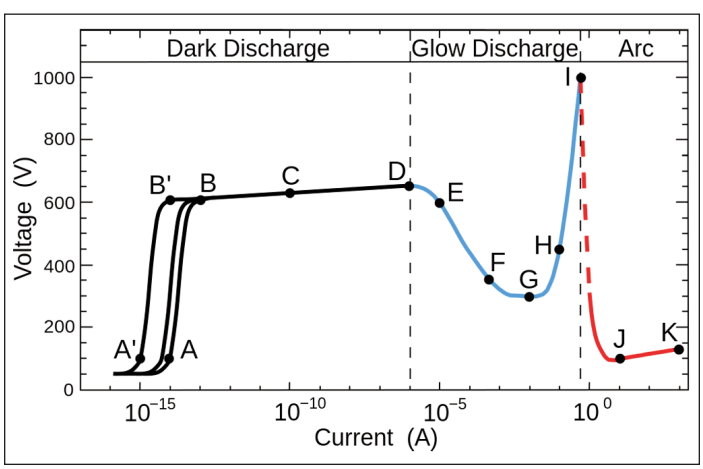

Figure 4. Plasma current vs. voltage.

At the moment when a blob of metal at one potential is just starting to make contact with a blob at a slightly different potential, there is the very strong tendency to eliminate the potential difference, which requires a massive current that will create conditions favorable for producing hydrinos.

Why did Mills want to operate in these conditions? Because he wants power density, which is caused by a high hydrino production rate. He achieved hydrino production with resonant transfer of energy from the collapse of hydrogen into hydrino, operating in electrolytic, solid state and gas phase (glow discharge) regimes. What happens when this occurs is ionization of the atom or molecule to which the energy is transferred, the catalyst. The catalyst used in this arc phase reaction is a nascent water molecule, newly formed from the oxygen in the gallium and the dispersed hydrogen. Nascent means that the water molecule is not near other water molecules, which would inhibit its catalytic action. Ionization creates free electrons, which are charge carriers, so in that local area there is a sharp increase in voltage gradient. This creates conditions that disfavor more hydrino formation, so the reaction rate is low, and the power density is quite limited.

It is my understanding that Mills had the insight that if the area near the hydrino formation was already saturated with electrons, that adding some more would not have a significant effect on voltage gradient, and so not change conditions to disfavor more hydrino formation. This means that hydrino formation does not quench further hydrino formation, and the reaction rate explodes, literally. In arc conditions, we could expect monatomic hydrogen in relative abundance, compared to molecular hydrogen. This nascent form of hydrogen is what is required to make hydrino.

These videos are of a reactor with a fixed, small amount of hydrogen in an almost all inert argon atmosphere. This is to limit the heat and concussive energy generated, which has been destroying reactor vessels. By having a small "inventory" of hydrogen, and pulsing the electric current across the liquid gallium electrodes, the reaction is of short duration, and the concussions do not build into a resonance that destroys the reactor. Mills mentioned high speed video of the vessels being destroyed, which I expect shows increasing oscillatory behavior (resonance) that resulted in shattering.

Yet, we know that this reaction has been run at high power in an open reactor, without destruction. Within a glove box, it was run to the point where the quite large volume filled with plasma (the mind boggles), for extended periods. Under those conditions, the concussion was not destructive. Yet, a closed container contains the energy, to the point of destruction. The solution to the problem is probably a matter of getting past the startup, past the initial high brisance when the only path for current flow is within the liquid silver (or gallium). As metal vapor fills the space, the whole volume fills with charge carriers (plasma), atomic hydrogen and the nascent water catalyst. The shocks are then dispersed, continuous and of much smaller amplitude. So, instead of violent shock waves, the vessel walls are subjected to pressure. Startup is the next hurdle, not only in melting the silver (if not using gallium), but in making it through the early violence without destroying the reactor, arriving at a steady-state plasma condition. The breaching of the reactor and the hot spots indicate that the plasma filament is large. There is only one hotspot, and it is stationary. As the reactor reaches steady-state, the interior would be dense with metal plasma and a profusion of tiny filaments, so the heat would be distributed among many filaments.

So, how does Mills bring the reaction through the dangerous phase? There are parameters under his control, particularly now that the reactor is closed and the atmosphere can be controlled. Current density can be high enough to initiate hydrino formation (but not so much sudden hydrino formation that the shock waves become destructive) by restricting the flow, pulsing the current, controlling the voltage, controlling available hydrogen and available catalyst.

I do not wish to make it seem easy, especially because the reaction kinetics are so violent. I am giving my opinion here. There are ways to moderate the violence long enough to grow the plasma slowly and protect the vessel. It appears to me that this is likely to take place within the next few months. The resources, the motivation, the talent and the rewards are all present. They must be careful to avoid setbacks. The power is very great and people have been killed by a lot less power. A vessel releasing a lot of power suddenly is called a grenade.

A fairly recent update was provided from Mills, in a BrLP report.[5] This contains much material previously published, and updated, such as news of a recent publication in the *Chinese Journal of Physics*.[6] The August update also details specifics in the current SunCell reactor development. The August report[5] has drawings of the much anticipated magnetohydrodynamic design, starting on p. 21, and includes a great deal of detail.

The high-speed video[3] reveals much detail of the plasma forming, even when slowed 67X, happening very fast. The vessel is a quite large Pyrex apparatus, which reduces the shock on a given area considerably compared to the graphite vessel, but the first one of these was broken. It is possible that Mills will want to go with a large graphite vessel, making the SunCell a much larger device, capable of much higher power. This might be an intermediate step, taken to finally get a commercial device on the market.

From my perspective, there is every reason to be as optimistic as ever. It is unwise to try to predict when the "autocell" will be ready for producing electricity, but as long as BrLP continues to produce steps (however small) toward the stable, automatically regulating cell, I see no reason to doubt success is getting closer.

At that point of development, handing it off to third party prototype developing groups, *i.e.* Colombia Technology, would seem prudent, but after the last pile of money was burned there in melting a cell that did not incorporate a failsafe mechanism for protecting the reactor from meltdown during the silver melting, Mills may decide to keep it in-house.

Mills was inspired to put the concentrator photovoltaic (cPV) development on the back burner, in favor of a reapplication of an old favorite design theme: magnetohydrodynamics (MHD). This was first considered by Mills to be a favorable path when he was developing glow-discharge plasma cells. The relatively low power density available with glow-discharge would mean that the generator required for useful power would be on a massive scale, and the economics were not so favorable, not to mention the regulatory obstacles (which would refer back to the obstacles of scientific acceptability).

Now, however, with the SunCell power density, based on a reaction measured to produce 20 megaWatt from a 10 microliter volume, the only obstacles are engineering, and those obstacles are steadily falling.

In the first installment of this series for *Infinite Energy*,[7] I brought up the chapter from a book by Erwin Schrödinger, initially published in 1944, entitled *What is Life?*[8] I consider repetition worthwhile here, because of some new information, indicators that the worm is turning, that the opponents of Randell Mills are facing an increasingly uphill battle, that grassroots knowledge is spreading.

The reason I find the Schrödinger chapter of such relevance is the influence that this chapter had on me, concerning the origins of the quantum theory credited to Schrödinger, before I knew much of anything about Mills' Grand Unified Theory of Classical Physics (GUTCP). The chapter is "Are there Quantum Jumps?" In this chapter, Schrödinger expresses grave concern that his QM has led the world astray, and what the consequences of such derangement may be, how long they may last, what the historical precedents are and what clues he finds for a true theory concerning atomic physics. He draws a strong parallel between the epicycles of Ptolemaic astronomy (an epitome of derision for any theory that is living way past its useful life) and quantum jumps, which require that the electron move from one energy state to another without ever having been in between states. Quantum jumps are a mathematical convenience, and is just one of the ways in which QM displays its non-physical character. He quotes Farrington (*Greek Science*), that "History is the most fundamental science...A great part of the mysticism and superstition of educated men consists of knowledge which has broken loose from its historical moorings," and so unifying physics is a far greater concern than finding a theory to meet the exigencies of the day. This chapter of Schrödinger's book was a mea culpa.

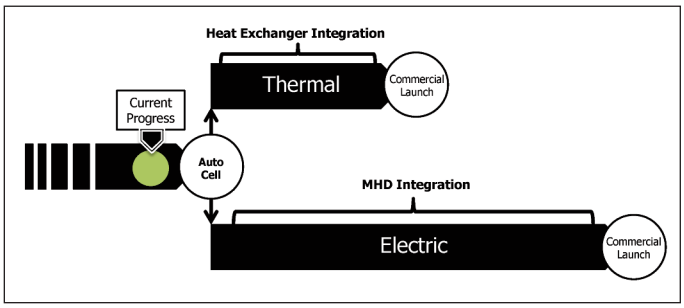

Figure 5. BrLP autocell.

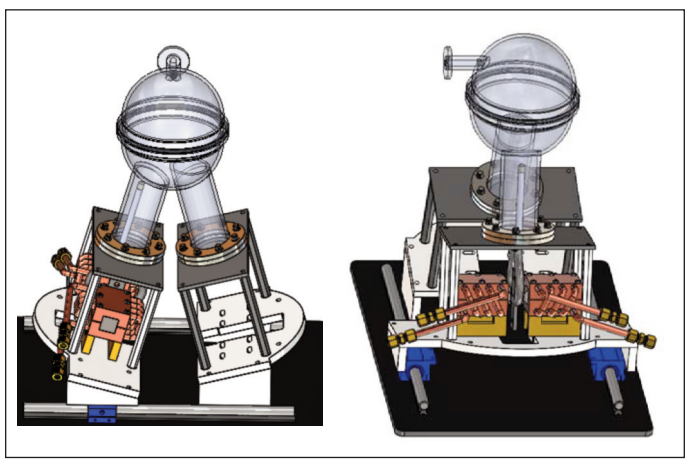

Figure 6. Pedestal cathode design is operational as test bed for hydrino plasma reaction chemistry and heater development.

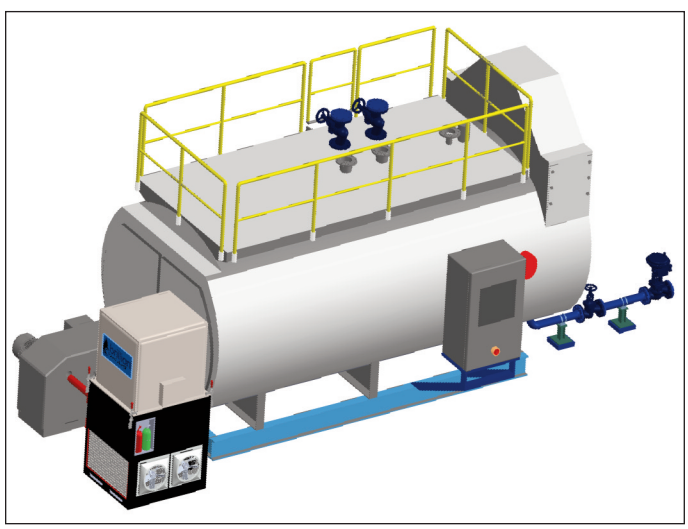

Figure 7. SunCell boiler integration.

What is concerning is that the book *What is Life?* was recently reprinted. The publisher has a page listing the original publication date of 1944, which could lead one to infer that this is a republication of the original. However, this chapter—the salient point of the book, if you ask me—is missing from the reprint. (Why?!) Used copies of the edition I have are available for $20. Prices were much higher not long ago. Go figure.

Then there is Thomas Stolper's very informative gathering of information on a subject human whom he realized was quite outstanding: Randell Mills. The book has a couple of titles, with some difference. I can find one used copy of *Genius Inventor* for $1594. I'm still not selling mine. However, if Mr. Stolper is reading this, take this as a warning that someone will soon pirate your book for making some fast cash, and it will not be me. Please reprint it.

Brett Holverstott knows already that his book, *Randell Mills and the Search for Hydrino Energy*, recently went out of stock on Amazon again, because he has remedied that problem already. The used price was climbing fast. Congratulations, Brett. This is probably a Kuhn's *Structure of Scientific Revolutions* sort of book, that will sell through a great deal of reprinting. The audience is broad, thanks to Holverstott's wide-ranging intellect. The understanding of the philosophical challenges that were faced by the scientists during the dawn of the Standard Theory of Quantum Mechanics that Holverstott explores in fine detail is invaluable. This is a book for laymen, and out of date, but the quickest way to get the big picture.

In the August report from Mills,[5] there is revealed much detail about an alternative path announced to the cPV SunCell, so there are actually three paths now. For any progress to be made on any of the three, the "autocell" must be reached (see p. 77 of the report, and Figure 5).

The thermal branch will require the heat transfer from the autocell to a traditional boiler. This design is well underway, and the excitement about getting the reaction stabilized in a closed cell is justified because the boiler development is apparently soon to be tested.

Photos of the fabricated unit are in the update. The quartz

dome is being fabricated. (See p. 61 of the report and Figure 6.)

This will give the world a source of superheated (400°C) water, which a great deal of existing infrastructure could use. (See p. 55 of the report, and Figure 7.)

So, the first application may be central generation, after all, but it still might need to jump through regulatory hoops, depending on application and magnitude. The other path of development, seen in Figure 5 herein, shows a longer path of development to the MHD product, a device that would be quite small in comparison to the thermal path, and the efficiency would potentially be extremely high, in the 80% range.

Mills' recent journal publication[6] states that a water entrained (containing a very small amount of water) tiny blob of solid silver that is subjected to very low voltage, and very high current, yields a power density of 20 million Watts in the volume of 10 microliters. The yield represents energy that is 250X as much as the energy required to initiate the result. This is what makes it possible for this reaction, if it is continuous and harnessed, to make a reactor that can produced hundreds of kilo-Watts, literally out of thin air, that is, the moisture in even dry climates.

Knowing how clever Mills is, from close observation over many years, he may be getting very close (a few months) to fruition.

Sadly, I must report that Mills has chosen to discontinue the long time public discussion on Yahoo under the title Society for Classical Physics (SCP). This has been a source of much education and fascination for many people, like me, for years. He states that he may be continuing with a business blog, and we cannot complain, not with all the video and technical material published by BrLP. Clearly, SCP Moderator Dr. John Ferrell, an accomplished academic, has performed an excellent service in maintaining civility in the discussions, and doing much to facilitate communications. Being that Ferrell was Mills' teacher in QM (Physical Chemistry), who became his student's student, he is a living testimony to the strength of the GUTCP. We wish him all the best.

The timing of this termination has stimulated some speculation on Yahoo and Reddit. It happened shortly after what could be considered a major milestone in research, that is, being able to close the reactor and operate it without instantly destroying the reactor vessel. In a short time after the initial success, longer run periods were reported, including controlled hydrogen injection, and more reactor destruction.

Nature often does not yield so easily, however, and there are no such promises of an imminent commercial prototype suggested by BrLP or me. There is steady progress and an exciting parameter space to explore.

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About the Author

Wall spent 23 years working for the federal government, mostly doing field engineer work in RADAR and RADAR automation. His experience with instrumentation impressed Dr. Mallove, who hired him after learning about Wall's attempt at building a calorimeter for investigating the early Mills electrochemical work using nickel electrodes. His interest in anomalous phenomena was greatly stimulated and fed during employment with New Energy Research Lab, in the company of some very interesting and intelligent people. This was from 1998 to 2000. Wall is retired now and largely focused on understanding GUTCP.

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