Протон-21

(proton 21)

the New Fusion

STANISLAV ADAMENKO ON PROTON 21

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By Tim Ventura & Dr. Stanislav Adamenko, August 13th, 2006

By subjecting a copper electrode to a gigawatt pulse of energy, Dr. Stanislav Adamenko believes that he's found a new form of fusion that occurs inside a millimeter sized plasma that forms in the electrode. Has Adamenko finally cracked the code of solid-state fusion, and what potential for future energy does it hold? He joins us for the inside story on Proton 21's research into creating "The New Fusion"...

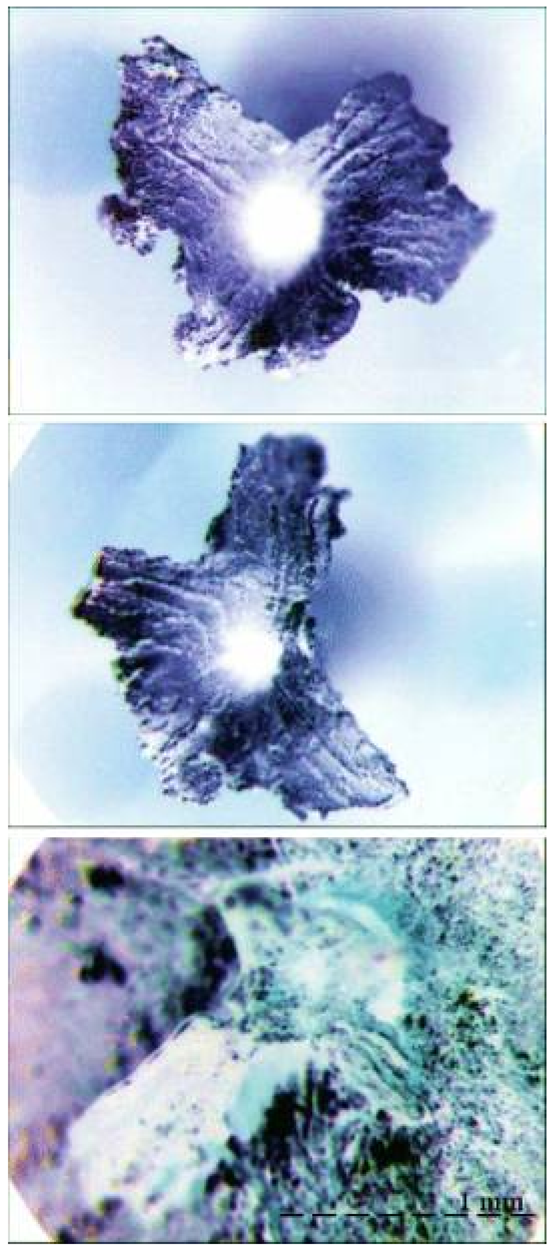
AAG: I'd like to start out by asking you about the background & history of the Proton 21 Electrodynamics Laboratory. How were you founded, and what inspired you to begin conducting fusion research?

Adamenko: It's difficult to write a concise history of Proton 21, because it begins, at least for me, as early as half a century ago. It all began with a number of insignificant events that at first appeared to be completely unrelated, but eventually became the inspiration for today's research. Without those synchronicities, I doubt that Proton 21 would exist today...

We're working on assembling a detailed history of Proton 21, which will appear in the introductory section of a book we're publishing about our research through one of the big European publishing houses. Since that project is really going to provide the most comprehensive view of our work, I'll just review some of the main stages of our research in our interview today.

At the end of 1958, when I was a very young man, I first became acquainted with the problem of controlled thermonuclear synthesis (CTS). This problem seized my imagination. I strongly wanted to believe in the existence of a simple and elegant solution, similar to the natural mechanisms in the synthesis of optimum structures. The search for a solution took many years.

By the end of 1979, as a result of my work on a dissertation devoted to analytical methods for the synthesis of multidimensional dynamical systems with optimum stability, I arrived at a realization that allowed me to see the conceptual unity of two



Target Samples: Color-enhanced views of several Proton-21 CTS target samples.

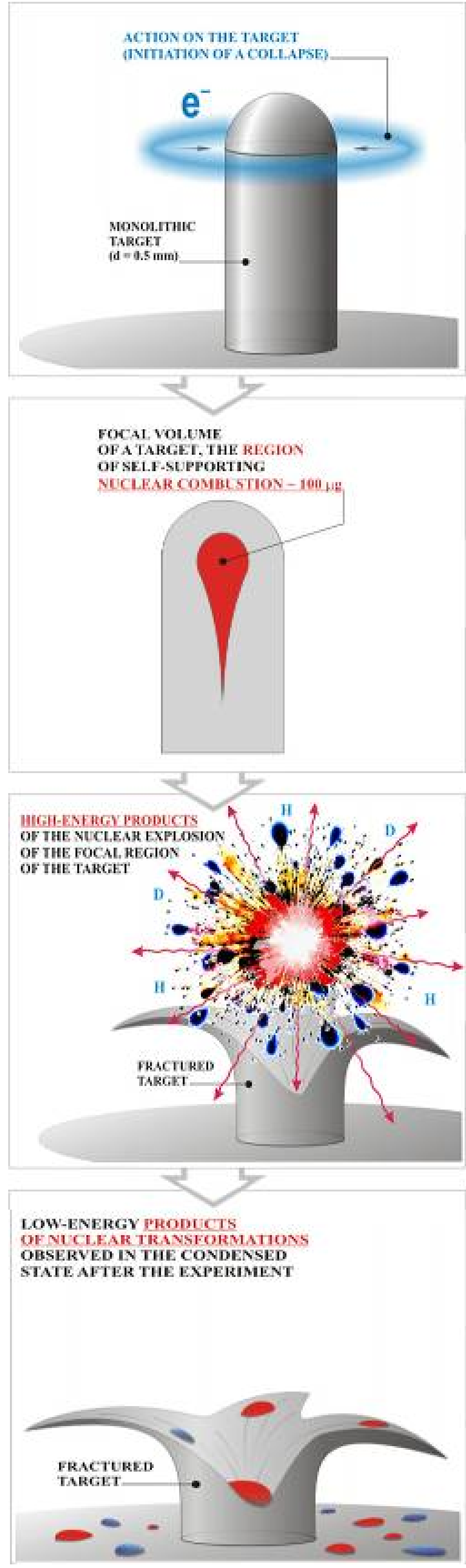
problems: the synthesis of an optimum dynamical system and the controlled nuclear synthesis. Both involve the formation of dynamical structures possessing optimum inertia relative to force acting from outside. We call this force "the general dominating perturbation" due to its role in forming systems.

It was obvious that the role of a general dominating perturbation, at least in the astrophysical processes of explosive nucleosynthesis we see in stars, is ideally played by the gravity of a collapsing cosmic body. I was hopeful that a process might exist that could be replicated under terrestrial conditions which could fulfill the role of a general dominating perturbation, and would thus be a catalyst for nuclear synthesis with the formation of a mass defect with that or another sign (i.e., with a change of the total inertia of the initial components).

During this same period of time, another group of scientists had formed an initiative group that was working towards establishing the "Kyiv Laboratory of Electrodynamic Studies", which later became Proton 21 as a private research laboratory. The Kyiv Labs team performed research in the following fields: nonequilibrium processes; thermodynamics of flows; pulse processes and nonlinear waves in plasma; focusing of dense hard-current electron beams, collective methods of acceleration; nuclear processes in biological systems; physical vacuum and elementary particles; two-body nuclear reactions; and other problems involved with nuclear synthesis as well as synthesis as a phenomenon in itself.

In 1996, as a result of several almost spontaneous meetings, a new initiative group was formed by experts from Kyiv and Kharkiv, who were interested in the problems of CTS and in new means of energy concentration. I served as both the organizer and the initial sponsor of this group until friend of mine took over this responsibility in 1997 - the director of a large Ukrainian building company. Unfortunately, it soon became clear that his other engagements simply overwhelmed his ability to fulfill this role.

In 1998, we appealed to another Ukrainian holding company with a proposal to invest in the first stage of the scientific-technical project named "Luch". We were lucky, and, in May 1999, the holding company established the "Laboratory of Electrodynamics Studies" under my guidance.



Solid-State Fusion: An overview of the Proton-21 CTS process in a solid target.

AAG: I've heard that Proton 21 was originally financed by a large Ukranian construction company, and that at one time it employed nearly 250 scientists in a former Soviet isotope-production facility in Kiev. Can you elaborate a bit on this interesting background for us a bit?

Adamenko: The information contained in your question is true on the whole, but I'd like to clarify things a bit:

First of all, the second sponsor of our project – the director of the large Ukrainian building company – is not the primary financier for Proton 21. His early support ceased in 1998 both organizationally and financially, and when he renewed participation with us in 2004, it was as a partner in a larger group of investors. Since 2001, the other members of this group have been the directors and owners of one of the large Ukrainian holdings, and have made the most essential financial contribution.

Also, our staff at Proton 21 never exceeded 100 people, but the total number of experts who we actively participated with certainly reached as many as 250 people. Those engagements came about for a variety of reasons, including personal motivation by people interested in learning about our research as well as others involved with making scientific measurements, studies, design, or producing equipment relating to the project.

The production center of the Proton 21 facility is located on the premise of a former Kyiv state enterprise dealing with the encapsulated sources of radioactive emission used in industry. The buildings & facilities of this enterprise were purchased by Proton 21 from the state, rebuilt, reconstructed, and equipped for solving the new problems during the transformation of the laboratory into an independent firm.

AAG: As I understand things, a lot of your research has involved pulsed plasma experiments in which a pure copper electrode literally explodes from the inside out during high-energy pulsed discharge experiments, which led you to hypothesize that a fusion reaction may have been occurring within the electrode. Can you describe this research a bit for us?

Adamenko: In May of 1999, we undertook a rather bold commitment over the course of 9-months

Target Samples: This closeup shows target samples exploded from the inside.

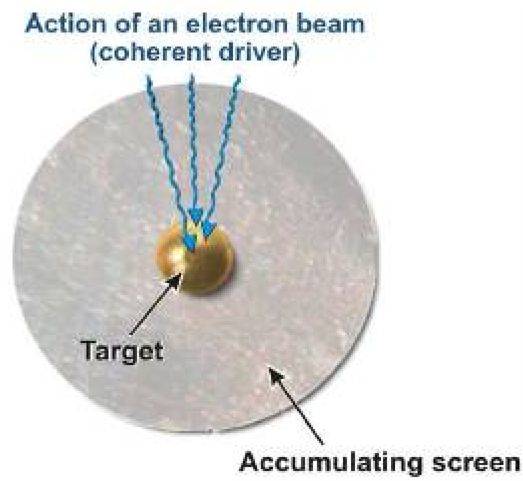
to construct an electron accelerator to use as in a driver of CTS. Our goal was to assemble a system to exceed the Lawson criterion in a metallic target at the expense of the compression and the confinement of the plasma on a target by the magnetic field of a self-focusing electron beam.

We spent 3 months trying unsuccessfully to make our confined plasma fusion scheme successful, and in the process, I came to understand that the initial concept for implementing the force driver is unrealistic and unproductive. It was a critical moment in time for us. Suddenly, I had an epiphany -- that we could use the same beam, but this time as a material carrier of the mentioned mass force, i.e. as the general dominating perturbation initiating a collapsing soliton-like wave-shell of the particle density in the surface layer of a target. This will yield the formation of a cumulative cascade of self-organizing nonlinear physical processes inevitably leading to the collapse of the wave, whose termination will be associated with the limiting concentration of substance and energy at the target center, to be more exact – at its microscopic focal volume.

The day that we undertook our first attempt to generate shock compression in the target material was one of the most delightful days of my life. Our experiments were immediately successful. Less than a year after beginning the experimental stage of project "Luch," we registered the occurrence of an event which can be undoubtedly considered as a pivotal moment in the history of Proton 21.

On February 24, 2000, at 6.05 p.m., a micro-supernova with a mass of 1 mg flashed and shone for 300 ns (30 ns in the X-ray range). The target – a metallic cylinder of 0.5 mm in diameter – exploded from inside. Its remnants had the characteristic form of a conical crater with lobes passing into a deep channel along the axis, which indicated that we had attained maximum energy density and focused it correctly along the axis of the target.

The splashes of low-energy products of the explosions of targets are well seen on the lobes of the fractured targets and on the accumulating screens near their bases:



Initiating Driver: A cascade-effect occurs during the shock-discharge CTS process.

The subsequent X-ray measurements demonstrated that the focal region within the target is shaped like a teardrop with a diameter of less than 10^{-2} cm (in the case where we used targets of about $5 \cdot 10^{-2}$ cm in diameter), and with a length that spanning more than two target outer diameters. We found that the effective temperature of the substance at the focal point is equal to 35 keV on average, which corresponds to $\sim 3.5 \cdot 10^{8}$ K. We believe it's more than just coincidence that this is the same characteristic temperature as the thermonuclear processes that occur inside white dwarf stars.

For several days after the first successful experiment, we succeeded to get 100% repetition rate for the axial explosion in targets manufactured from a variety of different materials.

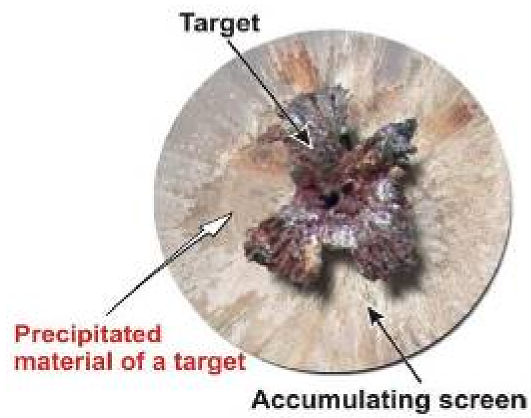
Over the course of several months, we determined that up to 20% of the mass in the target sample underwent nuclear transmutation into a variety of elements not found in the original sample. We used X-ray spectrum microanalysis and mass-spectrometric studies to determine this. Surprisingly, the products of these explosive reactions did not exceed the background values for radiation. This went against our initial expectations, because our concept of self-organizing synthesis of nuclear structures created by a coherent shock action does not assume the production of unstable atomic nuclei. After several hundred analytical studies of measuring the post-experimental composition of our target samples, it became clear that the statistical mean curve of the abundance of chemical elements created in our experiments are close to those characteristic in the Earth's crust. The main difference is that the concentration of heavy elements was somewhat higher in our targets, most noticeably in the element lead (Pb). In view of the enhanced stability of the double-magic nucleus 208Pb, we were not surprised by this fact.

We also unexpectedly observed that the value of the ratio of the integral mass defect for identifiable products of the nuclear transformation (from 150 kJ to 10 MJ in energy units) to the kinetic energy of products of the explosion of a target from 500 J to 10 kJ depending on the conditions of a specific experiment at the invariable supplied energy of about 300 J.

To really understand the significance between these experimental values, it's important to remember the incredible energetic potential observed during our experiments. While it may seem improbable, the main distinctive feature we observed is nothing short of a new natural mechanism for nuclear combustion. However, please bear in mind that our work is far from complete, and won't be finished for years to come...

AAG: Now the electrodes that you were using in these experiments were 99.999% pure copper, but post-experiment analysis indicated the presence of isotopic impurities in abnormal ratios that support the notion that you were producing actual fusion. Can you comment on the elements being created during these high-energy pulsed discharge experiments?

Adamenko: Just to be clear about things, the copper electrodes we used were around 99.95 to 99.99% pure. Now generally speaking, the concentration of the basic chemical element in various experimental targets is, as a rule, at least 99.92%.



Measuring: Nuclear products accumulate from the target on a 99.98% copper screen.

Anyhow, in terms of estimating the influence of admixtures in chemically pure targets on the composition of products of the nuclear transformation of their substances, the other circumstance is of importance. Namely, we have established the absence of any significant correlation between the concentrations of admixtures in a target and the observed abundance of the chemical elements identified as products of the nuclear transformation. This is not striking, because the total mass of admixtures in 1-3 mg of a substance, for example, of a Cu target undergoing the high-energy action does not exceed $6 \cdot 10^{17}$ a.m.u., whereas the total mass of, for example, only atoms of Fe or Pb which are always observed in the explosion products is at least of 1019 a.m.u., and the summary mass of all identifiable products of the nuclear transformation which are referred to the known part of the Periodic table is more than 1020 a.m.u. in some experiments!

In this case, our data indicates that the enhancement of the chemical purity of the substance of targets under consideration leads to the enrichment of the composition of chemical elements in products of a micronuclear explosion rather than to the impoverishment. It is also characteristic that, irrespective of the element composition of targets, the dominant positions in the relative abundance of the atoms in products of the artificial nucleosynthesis are permanently occupied by C, O, Na, Al, Si, P, S, Cl, Ca, Ti, Fe, Cu, Zn, Ag, Sn, Ba, La, Ce, W, Ta, Pb.

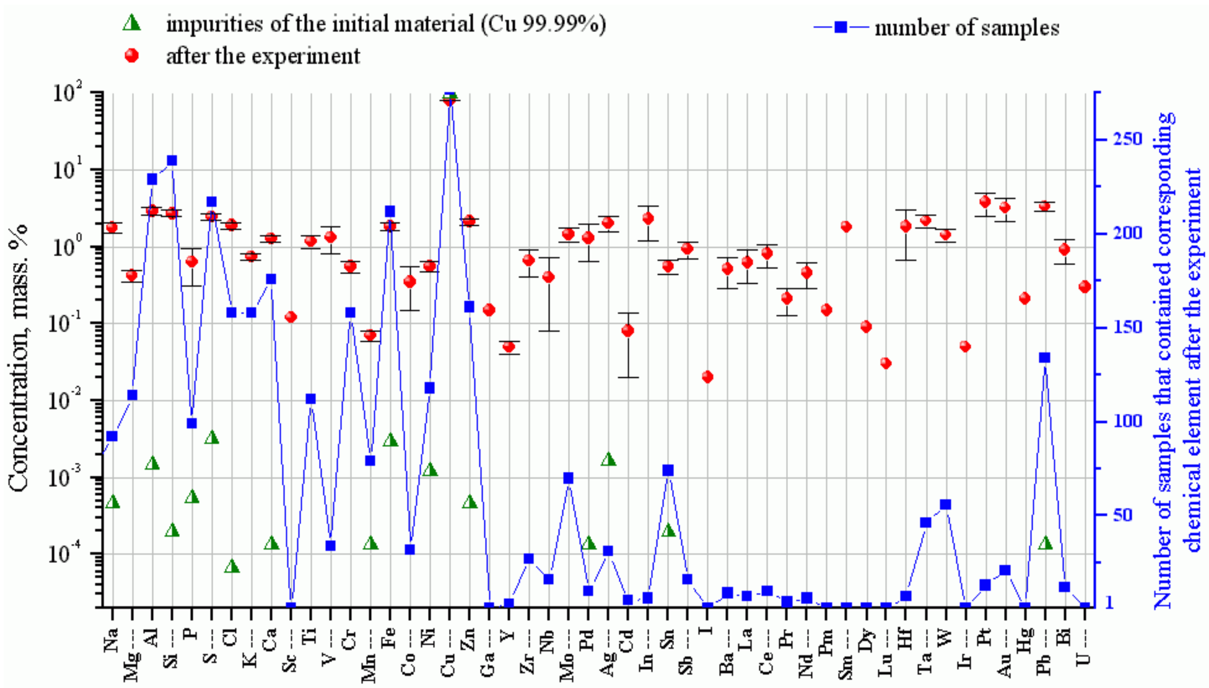


Fig. 5: Results of local analyses of the element composition in 277 copper (Cu mass. 99.99 %) accumulating screens, each of them was used in the experiment with copper target of the same purity. The method of investigation is X-ray electron probe microanalysis (REMMA102 device, element detection range is from Na to U).

AAG: Given the anomalous production of elements in your pulsed-energy discharge experiments, would you say that there is a possibility that stellar processes don't create matter through the "traditional standard model" and the "carbon cycle", but some sort of process similar to your "self consistent collapse" which generates net energy by creation of Super Heavy Nuclei, antimatter and conversion of matter to energy by "spontaneous" fission of super-heavy nuclei elements?

Adamenko: We've a collected samples and test-measurements from tens of thousands of successful laboratory experiments, and performed over 30 thousand measurements using a variety of different methods to accurately determine the element and isotope compositions of the products of the target explosions. However, we've never had the type of large-scale laboratory facilities required to perform a statistically significant series of comparative studies and measurements, including astrophysical ones, so it's impossible to say with certainty.

Nevertheless, I'm cautiously optimistic that the experimental data we're seeing in the laboratory is indicative of similar processes that create matter in observed cosmic phenomena. For example, the coefficient of correlation between the emission spectra of the exploded targets in our labs to those of supernovas, quasars, pulsars, and gamma-bursts in the energy range from 10 keV to 10 MeV is upwards of 0.92 to 0.99.

Now in the case of stars with longer lifecycles, like our sun, it's commonly known that their composition is the result of classical nuclear reactions as described by the traditional standard model. At the same time, it's also possible that solar fusion also includes a process that might be described as the "induced decay of superheavy nuclei".

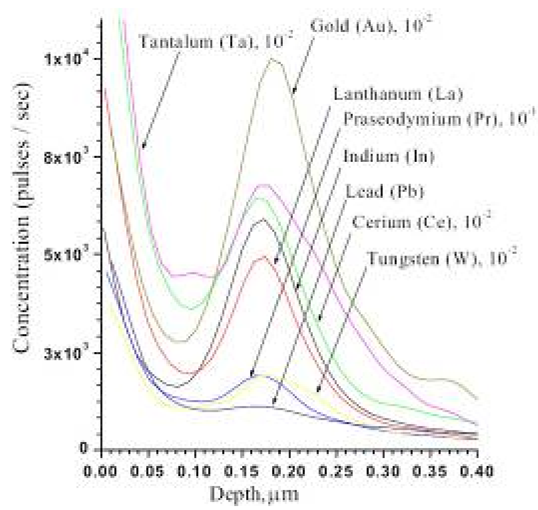
In the induced-decay process, the resulting fragmentary decay products of these superheavy nuclei are the nuclei of stable isotopes such as He, C, O, Ne, Mg, Si, S, Ca, Fe. These isotopes have a high internal stability in the nucleus, and hence the maximum probability to survive as semi-discrete local structures within the much larger nucleonic conglomerate structure of a superheavy nuclei. For superheavy nuclei with mass numbers approximately 10^3 to 10^6 a.m.u, at least two decay scenarios are possible:

First, for superheavy nuclei near the lower boundary of the indicated range and the minimum specific binding energies per nucleon, decay is possible due to the internal excitation induced by a low-energy external action.

Second, for larger nuclei (up to 10^6 a.m.u) with higher than normal per-nucleon binding energies, a constant growth & decay process may be at work in the solar environment. This would result from a growth period characterized by the absorption of lighter nuclei from the surrounding environment into superheavy compound nucleus, followed by a period of decay in which new light nuclei literally "boil" out of the compound nucleus in a manner similar to cluster radioactivity.

This form of "evaporative self-cooling" of the compound nucleus is characterized by a partial loss of mass as each cluster boils away that's not equivalent to the initial mass gained as light nuclei are absorbed. In a sense, this growth and decay phase involves the addition and subtraction of particles in a "two steps forward, one step back" process, which functions as a repetitive cycle within the nuclear environment until a potential well is reached with the attainment of the minimum of the specific energy of a nucleus per nucleon.

The specific binding energy per nucleon can range from 2 to 5 MeV for smaller superheavy nuclei up to 35 to 40 MeV for larger nuclei, with an efficiency from 3 to 6 MeV/nucleon in the first scenario above to 20 to 30 MeV/nucleon in the second, as predicted by academician A. Migdal. This gives us some exciting new possibilities for producing nuclear power where the net yield of usable energy can be 3 to 6 times higher than in the most efficient classical thermonuclear reactions.



Synthesis: A distribution of new elements in a target sample after explosive testing.

AAG: Let's talk about the energy side of your fusion research -- recently, the Sandia "Z machine" which is a wire Z pinch made a materials change from Zirconium wires to Steel wires. They observed (through X-ray emissions) a change in the plasma "temperature" from 2 million to 3.6 billion degrees Kelvin. They also observed indications of a net energy "output" from their plasma which was more than the calculated input to the plasma itself. Do you think they are seeing the same "self consistent collapse" that you see with your experiments?

Adamenko: Unfortunately, I don't know enough about the details of the Sandia Labs Z machine – at least in terms of driving an artificially initiated nuclear collapse. However, speaking very generally, I can say that I don't presently see any other way to initiate the exoergic nuclear reactions in macroscopic portions of the terrestrial materials other than through the driver-initiated nuclear collapse that I've described.

The conditions required to generate these reactions in our own lab involve the excitation of a collapsing wave-shell in neutral plasma, where the density and energy of the particles forming this plasma correspond to a particular extreme state that favors the bulk-generation of coherent nuclear reactions.

Thus, if the researchers over at Sandia used ordinary metals as a nuclear fuel and observed the positive energy yield, we can explain their results only by assuming that they have inadvertently recreated a process that we first publicly described at a conference in Messina, Italy, in October of 2002.

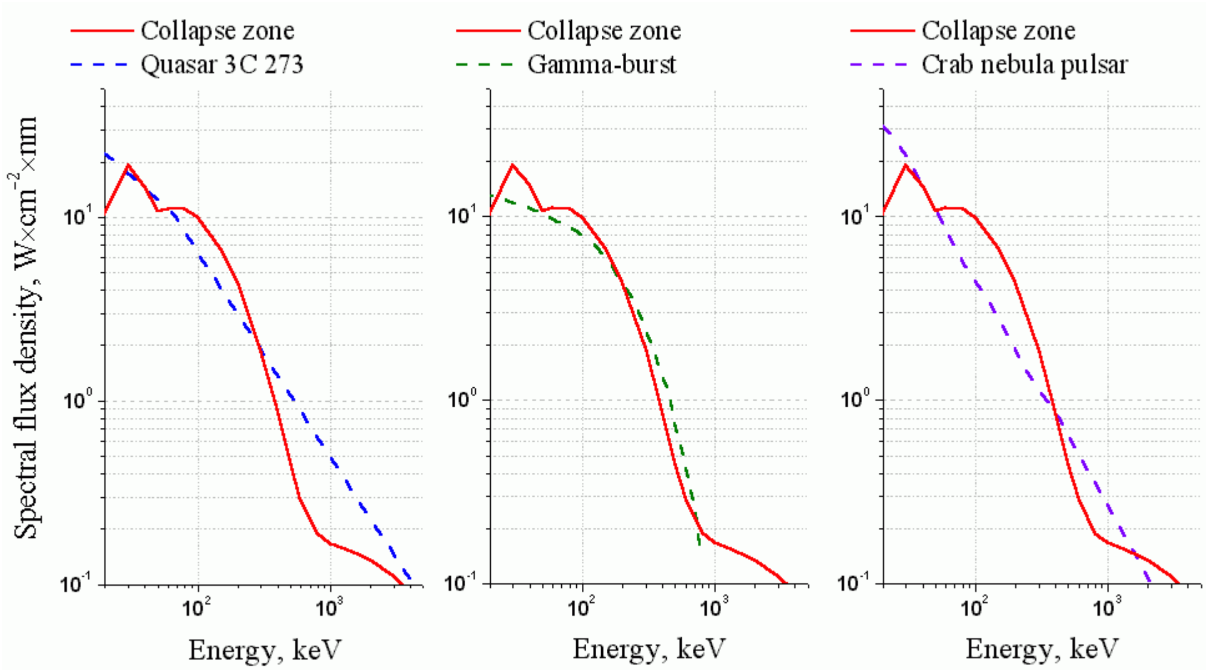


Fig. 6: Comparison of the emission spectra of the exploded target to those of quasars, pulsars, and gamma-bursts in the energy range from 10 keV to 10 MeV.

AAG: I understand the Sandia researchers are not doing analysis of the residuals from the Z machine pulses- they're only measuring the radiation produced during their experiments. Would you say that they may be missing something in not doing Auger/Xref (X ray emmission spectroscopy) and mass spectrometer work on the residuals from each pulse?

Adamenko: The type of analysis conducted at Sandia is naturally defined by what their research staff expected from the experiment and by their purposes.

In our experiments, beginning in February of 2000, we've purposefully initiated bursts of quasi-Supernovas. So in our case the analysis of the elemental composition of products of the target explosions were quite natural and planned.

I think it's important to repeat that if Sandia registered a yield of excess energy and don't ascribe this to zero-point, torsion fields, or other hypothetical, but noncanonized energy sources, there remains one process that does offer an explanation – the mass defect or the binding energy (either nuclear or chemical). If the possible chemical reactions cannot explain the observed yield, then it is necessary to search for the products of nucleosynthesis revealing the mass defect and a corresponding amount of the free energy.

AAG: What directions would you propose going in the future? How do you break the paradigm "block" which doesn't allow people to even attempt to do analysis which may verify your results at another institution with a pulsed power device which may be obtaining the same results you have?

Adamenko: The high-energy pulse apparatus isn't enough by itself to reproduce the experiments we're conducting at Proton 21 – to generate the required shock compression it's necessary to thoroughly reproduce the experimental setup described in our patent. Also, you have to carefully tune the apparatus in order to create the necessary conditions to generate the chain of self-organizing physical processes in the target and surrounding substrate. Without this you won't get a successful response from the initiating action of a beam driver.

It's a complex process, but we're open to participating with other organizations in an open, forthright manner in order to assist them with replicating these experiments. It's a collaborative strategy that will save everyone a lot of time and effort, and ultimately lead to the advancement of science and humanity. This approach to open, collaborative research is by far the best way to break out of the old paradigm and usher in a new era of understanding, and it's going to be something that we're going to direct a great deal of effort to over the next couple of years.


Explosive Inversion: Target samples are literally turned inside out from the explosion.

AAG: Does the research that you've performed offer any hope for Low-Energy Nuclear Reaction (LENR) technologies, such as Cold-Fusion, Bubble-Fusion, or anything along those lines?

Adamenko: I think that it is the central question of this interview, and the answer is unequivocally YES!!!

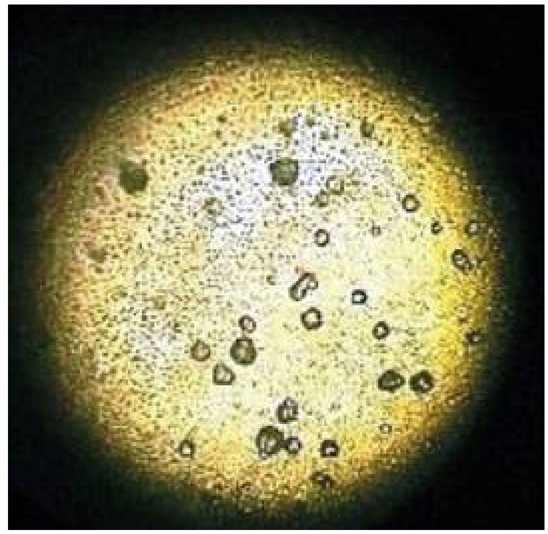
I believe that our theoretical studies and experimental research not only give the hope to the LENR-trend, but also significantly clarify the physical mechanisms underlying the LENR process. Thus, our work should allow researchers in the LENR field to understand the mechanism of these nuclear processes in order to optimize them for eventual use in commercial energy generation.

I believe that the collective and coherent effects of nuclear interactions in dense substances like the kind we use allow us to precisely describe the mechanisms inherent in LENR reactions, and also to finally explain the great number of accidental LENR experiments, in which various products or effects of nuclear reactions were revealed in a very unexpected manner. These include neutrons, newly synthesized chemical elements, changes in the distribution of natural concentrations of stable isotopes, and the emission of light, heat, and other previously unexplained phenomenon.

Some of the more traditional LENR experiments have an explicit relationship to our artificially initiated collapse. For example, let's assume for a second that the self-collapse of an artificially formed macroscopic bubble is possible. In this experiment, we're faced with the self-collapse of a disorganized and highly-inefficient collection of microscopic gas-bubbles where each event generates less than a trillionth of the total effect. Unless the collapse occurs in a coherent manner, the overall effect is negligible compared to its true potential. Coherency creates a cascade-effect in nuclear reactions that means nothing less than the difference between a pile of uranium and the atomic-bomb.

Simply put, we're dealing with physical processes that exhibit a strongly nonlinear dependence. A good example to consider is the amount of the excess energy released in an LENR reaction versus the amount of the active substance involved in the experiment– this is something that we've examined extensively in our own experimental research.

This nonlinear dependence explains why the majority of well-known LENR experiments demonstrate such extremely small yields in terms of energy production & nucleosynthesis, as well as why the results are so difficult to replicate or even accurately identify when they occur.



Fast-Ions: The detection of fast-ions in the detector after the destruction of the target.

I'm sure that in the next five to ten years, collective & coherent nuclear reactions will become the focus of major investment in the field of nuclear-energy research, and it will lead to the beginning of a large-scale transition to a new, environmentally-friendly means of producing energy based on collective natural nuclear transformations.

The technical publication that we're currently working on will contain a much greater depth of detail than I've been able to provide here on how our work applies to emerging concepts in energy. It will be a collective monograph of the leading experts in our research group, and as I mentioned earlier, it should be available in the near future.

AAG: Mysterious "black spots" were found on the copper electrodes during analysis with both optical & SEM electron-beam microscopes that appear to have some very unusual properties. Can you elaborate on this for us?

Adamenko: Carl Sagan once said, "Incredible claims require incredible evidence", so I've emailed you a bit of video that we shot of this anomaly. We captured this footage from the monitor of a "CAMECA IMS 4f" ionic microprobe in 2003. Unfortunately, while this anomaly was very interesting, we only conducted this particular series of experiments for a short period of time due to funding limitations. As a result, we were unable to document a sufficient number of events to draw any statistically reliable conclusions about the anomaly. Nevertheless, it's important not to discount the importance of this anomaly, regardless of the frequency with which it occurs.

The situation was as follows:

We were studying the nuclear transformation products of exploded metal targets by secondary-ion mass-spectrometry using the "CAMECA IMS 4f". We discovered a number of "spots" on the surface of several 99.98% pure copper accumulating screens, in which no scope signals from secondary ions were recorded. Secondary ions are normally dislodged from the screen's surface, and should have been present given the intense bombardment of the screen by primary ions. These spots were areas with a transverse size of about 50 to 100 μm that looked like irregularly-shaped black spots on the display.

So basically, the crux of our observation was the absence of a secondary ion flux in the scope for the entire range of ion masses analyzed by the device in the area of the black spots.

In following the normal procedures for interpreting the images of the ion microprobe, we can only conclude that in the case of these anomalous black spots, not only are they not composed of any of the known chemical elements, but they're also not composed of any type of previously undiscovered heavier element – in the case of our equipment, up to 480 a.m.u. which is the boundary of the range of IMS 4f.

Our operators have been making observations of this kind for decades, and this was the first time they'd encountered this type of anomaly. If it wasn't any type of known atom, then what could it possibly be? We obsessively searched all of the specialty literature for an answer, but didn't find any description of a similar phenomenon ever being documented before these events.

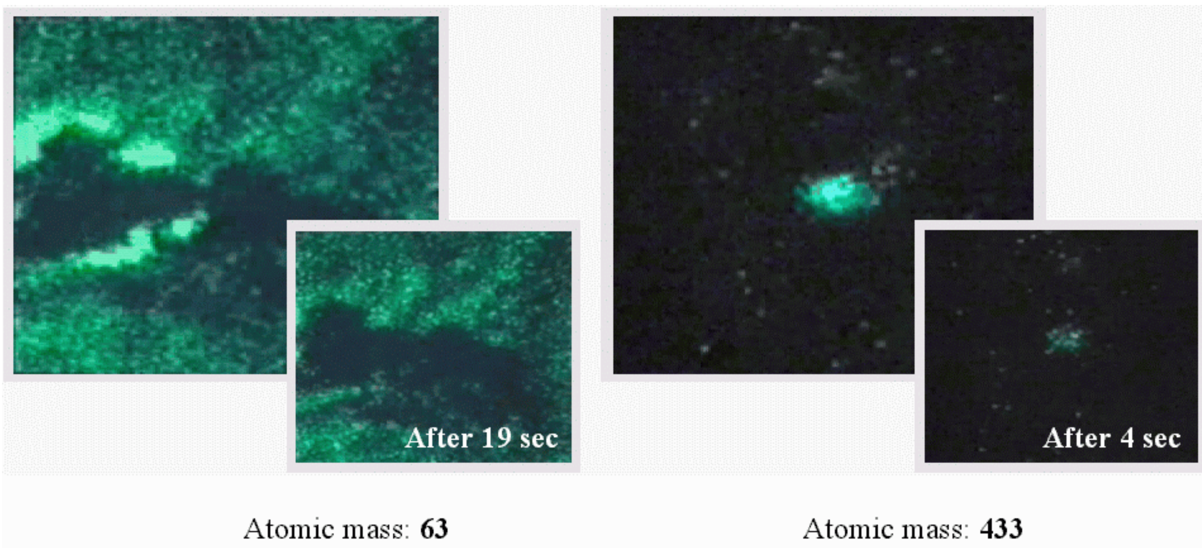


Fig. 7: The "black spot". Secondary ion images. Investigation method is the secondary ion mass spectrometry (IMS-4f device, analyzed mass range is up to 500).

We noticed something else, also – even stranger than the lack of secondary ions. We were subjecting the black spots to a heavy ion bombardment in an attempt to pick up a secondary signal when we realized that not only were we not seeing a secondary signal, but there was also a complete absence of a signal from the primary ions in the beam of a microprobe! The ions that we bombarded the spot with simply seem to have disappeared, quite literally without a trace.

At first I refused to believe that this could even be possible, because the primary ions are reflected (scattered) from any surface in such a great amount that the secondary image of these ions on the display is transformed always into a continuous glow on the scope's viewing-screen. This omnipresent background signal is the reason that the scope's display is automatically switched-off after a period of time – to prevent screenburn from the primary ions. As improbable as it may sound, the absence of reflected primary ions from the surface of the black spot must indicate that the primary ions arriving at the spot surface were captured by it!

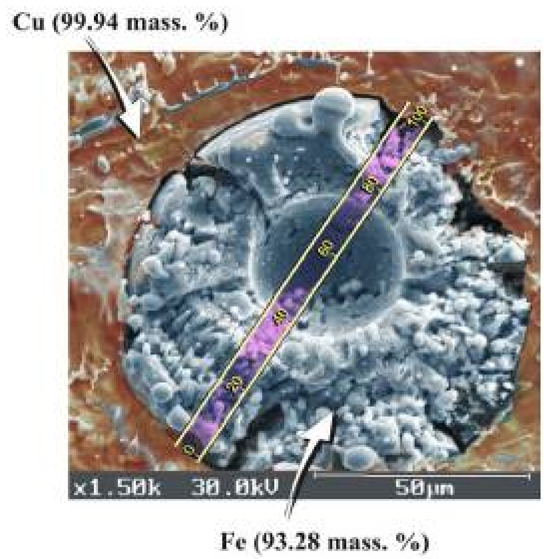
In another attempt to get a signal from the spot surface, the operator gradually scanned the whole dynamic range of masses of secondary ions accessible to the device. This was performed a while after the primary beam was switched-off. While slowly turning the tuning knob of the device, the operator noticed a flickering spot with decreasing intensity near 433 a.m.u. This flicker was positioned inside the black spot and occupied a small part of its area, and several seconds after the beginning of the observation, the brightness of the flickering spot decreased to zero (i.e. the luminous spot against the background of the black area disappeared).

We repeated this new experiment by switching the beam on again for several minutes and again switching it back off. The image of a flickering spot at a mass of 433 a.m.u. arose with the same initial brightness and again disappeared from view within several seconds. In both cases, the boundaries of the black spot were invariable.

After repeating this power-cycling & observation routine 12 times, we established that the initial luminous intensity of the 433 a.m.u. spot after a pause was proportional to the duration of the pause, and the decrease in luminosity intensity as it faded from view had an exponential character.

During the analysis of another black spot with the use of the ionic microprobe, the operator observed a pattern similar to that described above, but different in that the luminosity arose not inside the black spot, but instead occurred in a non-uniform manner along the length of the black spot's winding boundary.

We've only found one suitable explanation for these unusual effects. Consider for a moment the focal region of a collapse, where the density of the substance in a collapsing shell reaches extreme values approaching those characteristic of the conditions in a collapsing star. At the moment of transition from implosion to explosion in the collapsing shell, a strongly ionized substance is ejected consisting of superheavy nuclei in which the specific binding energies per nucleon are far below their maximum values.



Transmutation: An iron mass embedded in a 99.98% pure copper target sample.

Academician A. Migdal showed that the Coulomb barrier for such nuclei can be almost completely suppressed by a so-called "nuclear condensate" of negatively charged mesons which are formed in the nuclei in sufficient numbers to balance out the Coulomb field of nuclear protons.

I believe that these nuclei can exoergically capture the nuclei of the normal atoms that surround them when those atoms reach a certain resonant temperature range. After that, the decay cycle for these new superheavy nuclei will occur using the normal induced-decay mechanisms that I've described previously. The multiple repetition of this "absorption-boiling-evaporation" cycle leads to a growth in both the mass of the superheavy nucleus and its specific binding energy up to maximum values exceeding 105 a.m.u. and 35 MeV against the background of the nuclear transformation of the surrounding substance in the opposite direction.

The accumulation rate of products boiling off the growing superheavy nuclei will be proportional to the surface area of the superheavy substance in contact with surrounding environment, and inversely proportional to the difference in temperature of this environment from its optimum value to overcome the Coulomb barrier and hence contribute nuclei from nearby atoms to the growing nuclei.

Additionally, the position where this flux intensity is visible in the microprobe's display-screen is determined by the ratio between the creation of nuclei-fragments and the dispersion of atoms on their base by the primary beam, whose intensity and the duration determine the actual temperature of the medium (and the creation efficiency) and the dispersion rate of the created substance on the base of nuclei-fragments.

This is our explanation for the pattern of intensely luminous localized fragments of the surface against the background of the black spot. Also, depending on the output rate for products of the nuclear boiling-process, the pattern observed outside can look like either a nuclear glow or a nuclear nanoexplosion.

AAG: Extrapolating from the properties of this spot on a microscopic scale, if it were enlarged into a 10 cm diameter sphere, would it stand to reason that it would absorb matter with no reaction in the same way that the microscopic sphere absorbed billions of oxygen-atoms from the SEM microscope/ion-beam probe?

Explosion: A clean explosion of a target sample from internal plasma pressure.

Adamenko: It's difficult to answer this question without first mentioning that the observed black spots can include from 10^{15} to 10^{16} nucleons. In order to form a spot with an area of about 100 cm^2, we need that their number be 10^7 times more – from 10^{22} to 10^{23} nucleons or from 17 to 170 mg.

In our current experiments, the total mass of the nuclear products produced by each pulse is less by three orders of magnitude. Therefore, it would be pointless to discuss the production of film coatings made from some type of superheavy material.

On the other hand, I should point out that the absorption of ions from the primary beam doesn't exactly occur without any traces, but rather has certain consequences in the form of a nuclear boiling process as the byproduct of a growing superheavy nuclei.

AAG: As I understand things, in terms of creating useable energy from your copper-electrode experiments, haven't you written in the past that the major challenge to commercializing the technology remains the setup time involved with producing each energy-producing pulse? Don't these take nearly an hour to setup for each, despite the fact that they produce 10 times higher output than input?

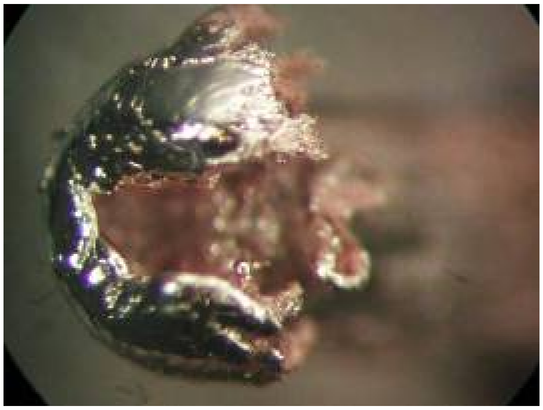
Adamenko: The technical parameters required for the commercialization of our nuclear combustion technology really depend on the application you have in mind, such as the synthesis of superheavy nuclei, the neutralization of radioactive waste, or the production of energy.

In the last case, in addition to the technical challenges involved you described with the repetition of pulses, it's also necessary to optimize several parameters relating to the initiating beam and the micro-targets to be used as fuel. However, the theoretical models of artificially initiated self-sustaining collapse that we've developed over the last five years were developed with this application in mind, so it's not an impossible task.

In the next year or so, we'll be in a position to allow computer-optimization to begin providing us with initial data to construct a prototype setup that we expect will yield significant positive energy.

As for the 10-fold excess of released energy over input, in order to understand the complex problem of utilizing the energy produced by artificially initiated collapse, consider that 2.5 kJ of excess energy can be carried away from the collapse region by protons at 10^{15} eV, in numbers less than 10^6.

At present, the minimum time required for the preparation of a pulse is about 20 minutes. This is mostly determined by the capacity of vacuum pumps we're using, the time it takes to change the target, and charge time for our capacitors. However, it shouldn't be difficult to modify our apparatus to deliver a pulse every few seconds, if desired – the modifications would be almost trivial. Now if you wanted to increase the pulses to tens or hundreds of hertz, then it would involve some major technical challenges – but even in that case, these are not insurmountable.



Closeup: An extreme closeup on a 2mm copper target sample after an experiment.

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Special thanks to Lev Malinovskij for his assistance in translation, which is greatly appreciated.