Adventures in Energy Destruction

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Abstract:

Author documents his personal experiments in *altering* radioactive decay rates by simple electrolysis with "primitive" equipment. References are also given to institutional experiments. Decay rates may also be influenced by Earth-Sun distance and by the rotation of the Sun's core. Temperature may have unexpected effects on radioactivity. Radioactive half-lives can be extended or shortened. Characteristics of "inside-out stars" are noted. Author also inadvertently found a long forgotten useful method of suppressing dendrite formation during battery charging. This article may be freely distributed for non-commercial or educational use. Author's right to own and maintain the document must be preserved.

Key words:

nuclear waste, spent fuel, reprocessing, Yucca Mountain, neutralization, remediation, uranium 238, thorium 232, Przybylski's Star, dendrite suppression, STEM

Introduction

Currently, the United States is constructing a nuclear waste facility at Yucca Mountain, Nevada. It will cost $57 billion (not including cost overruns) and serves only to STORE radioactive waste instead of neutralizing it. The waste must be transported by rail from 103 reactors, most of which are on the east coast. Transporting such extremely dangerous material from locations all over the country has raised serious safety concerns, especially since the events of September 11, 2001. And the storage site will have to be defended against intrusions and accidents for thousands of years.

Various other links:

Radioactive Roads And Rails: Hauling Nuclear Waste Through Our Neighborhoods,
https://pincdn.s3.amazonaws.com/assets/5F7uHwbKhTsl_oc6mfPtfg/RadioactiveRoadsandRails.pdf

http://www.osti.gov/bridge/
http://www.radwaste.org/

The Yucca Mountain project was cancelled by president Obama in 2009. The Federal government is supposedly looking into alternatives now:

> The time is long overdue for America to find a new approach for solving the nation's nuclear waste problem. That is why I was joined by Senator John Ensign in proposing the creation of a Blue Ribbon Commission of experts to make credible, scientifically sound recommendations for a new approach to nuclear waste.
>
> I am pleased that President Obama and Secretary Chu agree with this approach, and on March 3, 2010, announced the creation of the Blue Ribbon Commission on America's Nuclear Future. The commission includes distinguished nuclear energy experts, geologists, policymakers, and environmental policy experts. The panel will present their final report on the best alternatives to Yucca in early 2012. While this commission prepares its report, I will ensure that Nevada's health and safety are never again threatened by nuclear waste. http://reid.senate.gov/issues/yucca.cfm

Another good read is: *Nuclear Roulette: The Truth about the Most Dangerous Energy Source on Earth* by Gar Smith– October 25, 2012 https://www.amazon.com/Nuclear-Roulettehttps://www.amazon.com/Nuclear-Roulette-Dangerous-Solutions-Publications/dp/1603584773Dangerous-Solutions-Publications/dp/1603584773

On-site neutralization of radioactive waste at the power plant would make a lot more sense if the option were in fact available. Currently it is not. Scientists generally believe that radioactive decay rates are remarkably constant and that they cannot be changed by a simple, inexpensive process. The discovery of so-called "cold fusion" in 1989, however, changed all that. It became clear that radioactive decay rates could be affected by ordinary electrolysis. This led some scientists to propose that a process be developed for disposal of radioactive waste. Dr. G.H. Miley, for example, wrote U.S. Department of Energy Nuclear Energy Research Initiative (1999), Proposal No. 99-0222, "Scientific Feasibility Study of Low-Energy Nuclear Reactions (LENRS) for Nuclear Waste Amelioration". (http://papers.sae.org/1999-01-2725/) The proposal was actually accepted, but some of those "institutionalized, atherosclerotic precision mound builders" that I talk about, later killed the project. Apparently, this was just too big a mound for them to leap over.

See: http://www.infinite-energy.com/iemagazine/issue28/criticskill.html ,
Complaints about U.S. Office of Patents and Trademarks regarding Cold Fusion:
http://www.padrak.com/ine/POLETT899.html , Transcript of ABC's "Good Morning America" June 11, 1997
http://www.infinite-energy.com/resources/abc.html .

What we now need is more public awareness and support for the idea that neutralizing radioactive waste at the power plant may be feasible. Even a high school chemistry student could build an apparatus to demonstrate the basic principles. If our kids are doing it, then the universities and national labs will see their way clear to get this show on the road. Uncle Sam can tell them:

You don't need official permission from any governmental agency to demonstrate the basic principles of neutralizing radioactive waste that are described in the essay below. You just need enough courage to annoy a few authority mongers like those that were around a couple thousand years ago.

"And they said to Him, "By what authority are You doing these things?
And who gave You this authority to do these things?" --Mark 11:28, *NKJ*

My Equipment and Methods

First, I needed a Geiger counter, one that I could hook up to a computer The RM-60 Radiation Monitor from Aware Electronics (http://www.aw-el.com/) met my needs very well. It has a Geiger-Mueller tube that has an alpha sensitivity of 2.5 MeV, 80% at 3.6 MeV, a beta sensitivity that is 35% at 50 KeV, 95% at 300 KeV, and a gamma & X-ray sensitivity of 10 KeV. The unit can be hooked up to a PC and the software handles the radiation counting. The files can also be converted to a Comma Separated Variables (.CSV) list and imported into an Excel spreadsheet for more extensive data analysis. The user manual was also very informative and a pleasure to read.

Second, I needed some radioactive waste to play with. It turns out the stuff is pretty hard to get ☺. But actually I wouldn't want it anyway. It is just too dangerous to have around. I needed something a lot safer. It turns out thorium will work quite well. So will uranium. Therefore I bought some thorium and uranium nitrates from a chemical laboratory supply house (no NRC license is needed for these items in small quantities). Thorium 232 ($_{90}Th^{232}$) has a half-life of 14 billion years. That is short enough to make a sensitive Geiger counter crackle vigorously, but long enough to be very safe for careful experiments, the main danger being inhalation of the dust. Uranium 238 ($_{92}U^{238}$) has a half-life of 4.5 billion years and uranium 235 ($_{92}U^{235}$) has a half-life of 0.7 billion years. The latter isotope represents less than 1% of natural uranium, but as you can see from the half-life, it is about six times more radioactive than the 238 isotope. Both isotopes are significantly more radioactive than thorium and would be useful in advanced experiments. All isotopes decay into "daughter products" which in turn are radioactive. The decay results in the "thorium decay series" and the "uranium decay series". Radioactive series eventually terminate in a stable, non-radioactive nuclide like an isotope of lead or bismuth.

These are the basic materials and tools required for these experiments. The yellow crystals in the plastic bag are uranium nitrate hexahydrate, but most experiments can be done with the safer thorium nitrate tetrahydrate. The RM-60 counter connects with a computer through the serial cable.

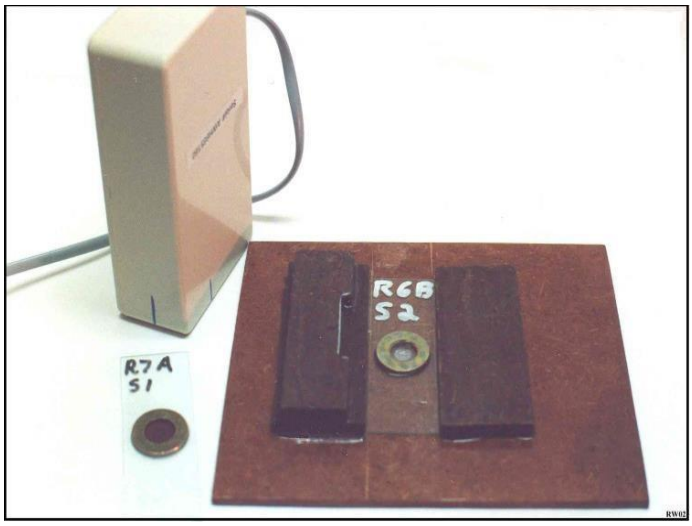
Third, I needed some fixtures to facilitate radiation counting. The fixtures would ensure uniformity and repeatability, which in this kind of research are extremely important. The bulk of the work in fact consists of hours and hours (or several days) of radiation counting. Running the reaction cell is only a minor part of the effort. Counts must be done both on electrodes as well as the (dried) liquid contents of the cell.

The scheme that seemed to work best for measuring the liquid portion was constructed from microscope slides that had an SAE 3/8 inch metal washer epoxied to them. The hole in the washer is slightly smaller in diameter than the aperture of the Geiger tube. I take the liquid I am going to process and make a set of "before" slides by putting 4 drops of the liquid into the hole in the washer and then fast evaporating it in an oven (about 200F). I repeat this until the hole has a total of 12 drops per slide (the hole will only hold 4 drops at a time). I usually do three slides as a set. Then I count each in the counting fixture in sequence, (slide #1, then #2, #3). Then I re-count each one until a total of three passes have been done on each slide. This gives me an idea of slide-to-slide sampling uniformity (about 6%) and measurement repeatability on any particular slide (about 2%)

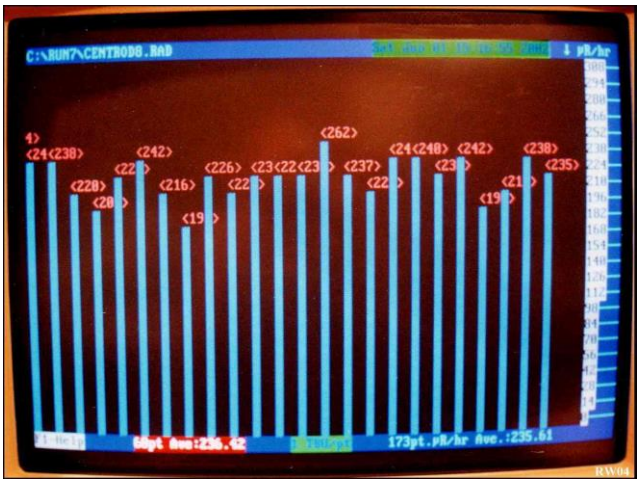
After the reaction cell is turned off, I make a similar set of "after" slides with the same technique. Electrolysis uses up a little bit of the water and some may have to be added to bring the cell back to the original dilution (less the 36 drops for the "before" samples) so that a valid comparison can be made. Also, the liquid may have a radioactive precipitate in it and so the liquid must be well stirred before taking samples.

The idea, of course, is to compare the before and after samples to see how the radioactivity has been affected by the electrolytic process. Both the intensity (counts above background level) and the shape of the decay curve are critical things to measure. You'll see some examples later.

After I am done "counting the slides" I cover the washer with a piece of cellophane tape, place the slide in a little plastic soap box (the kind used for travel) with the other slides, and store the box in a safe place. This is a precaution against contaminating my surroundings with radioactive dust.



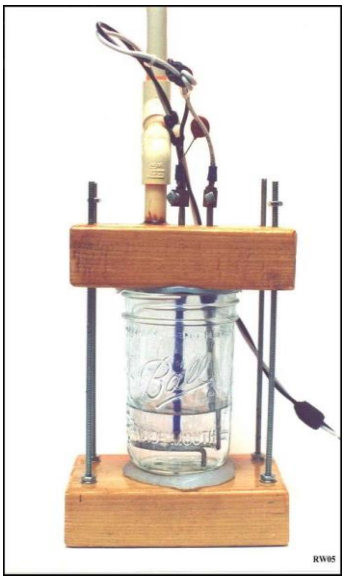
The slide counting fixture helps to position the Geiger tube directly over the hole in the washer which contains the radioactive material. Slides are labeled with run number, whether they are before or after the run, and the slide number. Computer file names also include a measurement pass number (such as R6B-S2P1.RAD). No other slides or radioactive materials should be near the counter during a counting process. Unneeded slides are normally stored in a little plastic soap box and kept in a safe place away from the counter.



This is what the computer monitor looks like during counting (an electrode in this case). At the far right side of the screen, the blue bar shows that 235 counts have been received in one Time Base Unit (one minute in this case). The display scrolls leftward as counting continues (usually for days). Electrolyzed radioactive materials often show periodic variations in the bar graph display, as well as in the data plots.

Fourth, I needed an electrolytic reaction cell and a power source to run it. I designed the cell shown in the photo while I was walking around in a hardware store. It is basically an ordinary Ball wide-mouth canning jar mounted between two blocks of wood that have been coated with marine epoxy. Liberal amounts of silicon seal are used for cushioning or sealing. The electrodes are 1/8 inch diameter stainless steel rods, which each go through 3/16 inch stainless steel tubes. This allows the electrodes to be removed for counting, cleaning, safe storage, or using a different type of metal for the electrode such as tungsten.

The cell is typically run with 1 gram of thorium nitrate tetrahydrate dissolved in 150 ml of distilled water. It may be electrolyzed with alternating current (AC) or direct current (DC). The threaded rods and nuts are part of a "positive control" scheme intended to keep this ungainly contraption in one piece when it is being moved around; this reduces the likelihood of inadvertently splashing hot, radioactive liquids or dropping the glass jar. The clamp nuts are removed before the cell is energized. Little sand bags (not shown) are placed on top to keep the lid sealed to the jar (the center area of the lid has been cut out with an electrolytic etch technique that uses salt water and a car battery charger).



This is my general-purpose electrolytic reaction cell. It has a provision for a reflux condenser that allows higher power levels to be investigated without boiling off the electrolyte. It is placed inside a 5 gallon plastic bucket before power connections are made.

This is a ground tungsten TIG welding electrode that has been partially sheathed in glass and silicon rubber sealant. It is made by injecting the glass tube half-full with sealant, closing off the full end with a finger, and pressing the electrode through it from the other end, causing the sealant to extrude around the electrode. The green marking on the right end means that this electrode is pure tungsten. A red marking would mean 2% thoria alloy, yellow means 1% thoria, blue means 3%, brown means zirconia. Lanthanated and ceriated rods are also available. Tungsten does not corrode as easily as stainless steel. It is also useful in experiments requiring cathodes of high atomic weight.

Before a run, the cell is placed inside a 5 gallon plastic bucket and anchored with another sandbag at the base. The bucket is intended to confine glass shards if the cell explodes during operation (electrolysis will generate potentially explosive combinations of hydrogen and oxygen). The clear packaging tape around the jar will also help to reduce the mess. A hole in the lid allows the cell to be connected to an air-cooled reflux condenser, which is just a four foot piece of CPVC pipe. It is open to the atmosphere at the top end and merely condenses any steam generated by the cell during operation at higher power settings. The vinyl tubing, which connects the pipe to the cell, has some stainless steel scouring pad loosely strung through it to demist any vapors from the liquid boiling below it. There is also a small view port which is covered with Plexiglas.

And yes, I run it in the bath tub (on top of a couple of car floor mats). I like having a wall and a door between me and something that could explode. The bathroom does not have pedestrians or inquisitive cats walking through it either. And the power comes from an outlet protected by a Ground Fault Interrupter (GFI) which should keep me from getting electrocuted if, in a moment of thoughtless inattention or complacency, I do something stupid.

The cell is powered by an old Superior Electric Powerstat. This is an autotransformer that can supply 0 to 140 volts AC at 15 amps (very overpowered for what I am doing). A small electric outlet box is wired so that a "load limiter" can be connected in series with the reaction cell. In this case the limiter is just a photo light bar with a couple of high wattage bulbs. In case of a bad electrical short, the lamps on the light bar will light up. This keeps the equipment from being damaged, the wall circuit breaker from popping open (and killing the computers on the same circuit), and me from becoming a nervous wreck. Another box contains a fullwave bridge rectifier in case I want to run the cell on DC. The cell power requirement at high voltage is estimated offhand to be 30-50 watts.

As you may deduce from all the above photos, the basic equipment shown is very primitive and built from spur-of-the-moment designs and junk box parts. It is nevertheless sufficient for proving that

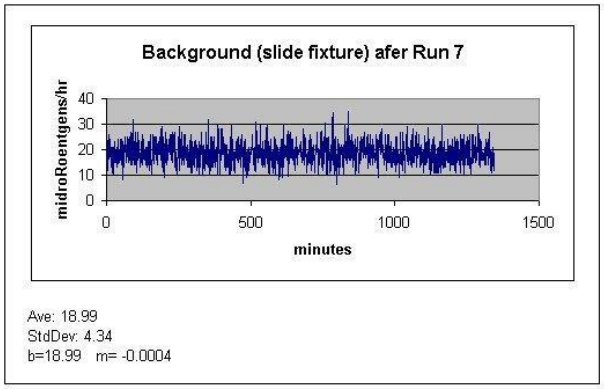
radioactive half-lives can be shortened from billions of years to a matter of hours by a quick and simple process.

Background Counting

For my nuclear physics amusement, I bought a 3 ounce container of Morton Salt Substitute from the grocery store and put it in front of the RM-60 counter. This salt ***substitute*** contains mostly potassium chloride instead of the usual sodium chloride. Potassium has a couple of stable isotopes that form the bulk of natural potassium: potassium 39 (93.26%) and potassium 41 (6.73 %). But there is also an unstable isotope, potassium 40, with a half-life of 1.25 billion years (more radioactive than uranium 238). Fortunately, it has an abundance level that is 0.0117 percent (one-hundredth of one percent) that of natural potassium. Nevertheless, its activity can be seen with a sensitive radiation counter. When I put the Morton Salt Substitute in front of the RM-60 counter, it registered about 30 microRoentgen/hr. Is this radioactivity enough to worry about?

To keep things in perspective, you need to know that the average background radiation in our everyday environment is about 5 to 25 microRoentgens/hr. It comes mostly from dirt, rocks, bricks, radon gas, and cosmic rays. Inside a jet at 30,000 feet the background might reach 300 microRoentgens/hr. Overall, the average American gets a cumulative radiation exposure equivalent to 10-20 chest X-rays per year. I measured the salt substitute inside a concrete building, where the background is about 19 microRoentgens/hr. The salt shaker therefore contributes only about 11 microRoentgens/hr above background. This is really not enough to worry about, not even if you have hundreds of these things in your coat, hundreds of them in your bed, thousands of them in your house. (and if you are ***that*** fond of salt substitute, you probably have ***other*** problems you need to worry about!). See also http://en.wikipedia.org/wiki/Banana_equivalent_dose .

The point, of course, is that we are continually bathed in a sea of very weak radiation. It unavoidably adds a "background" that must be taken into account when performing sensitive radiation measurements. I regularly take background readings on the fixtures that I use in my experiments, and then analyze the data in an Excel spreadsheet and plot it:



The count level, 19 microRoentgens/hr, from the fixture is essentially the same as that for the room in general. This shows that neither the RM-60 nor the counting fixture has been contaminated with stray radioactive dust. Note also that the curve is flat (albeit noisy); the background is essentially constant with the passage of time. We will later see that this observation is critically important for interpreting radiation measurements on materials that have been in the reaction cell.

My Early Experiments

First, I did a couple of shakedown runs to locate equipment problems and calibrate my level of nervousness. I used common baking soda (sodium bicarbonate) as the electrolyte.

The Powerstat gave me the most trouble. When I set the dial to zero and plugged it in, the circuit breaker at the main panel would pop open. I was left in the dark, and of course the computers crashed too (they were unavoidably on the same circuit). It popped the breaker in every outlet I tried, except for the particular *one* outlet that I used when I tested it originally! I got around the problem by adding a twenty foot extension cord and turning off a few lights. Later, during a run at higher power settings, the Powerstat would start sparking, hissing, and generating ozone. I had to take the thing apart, clean it up, and realign the rotor with the windings. After that it worked fine.

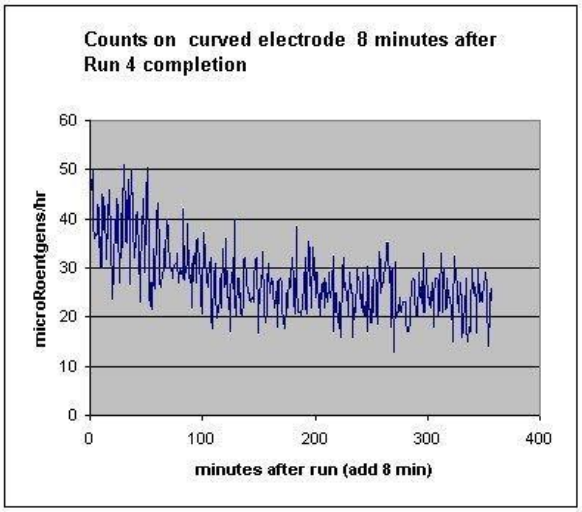
The load limiter, a simple light bar used for photography, had a little surprise too. It has a 500 watt bulb and a 300 watt bulb. During a run, the 300 watt bulb would start glowing first. I thought, "This is crazy. They are acting like they are connected in series." I had forgotten that years ago I had replaced the original on/off switch with an on/off/on DPDT switch, and I wired it for a series-start, parallel-run to extend the filament life. It was now in series and so I simply switched it to parallel.

I also cranked up the voltage as high as it would go to see if the cell could be run in the incandescent electrode regime. I was barely able to get the center electrode to incandesce. It would emit little sparkles of yellow light (due to the sodium) and make a hash sound on the AM radio that I laid across the extension cord. (My *ad hoc* noise filter, consisting of a ceramic capacitor and a couple of toroids was not very effective.) I was trying to avoid the incandescent mode for the first several runs, and so when I heard the hash unexpectedly, I turned down the power, but the noise did not stop. I traced the noise to a fluorescent light that had decided to go bad that day. Later, there was more noise, but this time it was apparently a motor in a vacuum cleaner. The power line was actually very noisy. I could not rely solely on the radio to detect incandescent mode (looking directly at a jar that has hydrogen, oxygen, and a sparking electrode is not my idea of a safe experience!)

Suffice it to say that practice runs can save you a lot of grief, especially if you are going to be using radioactive materials.

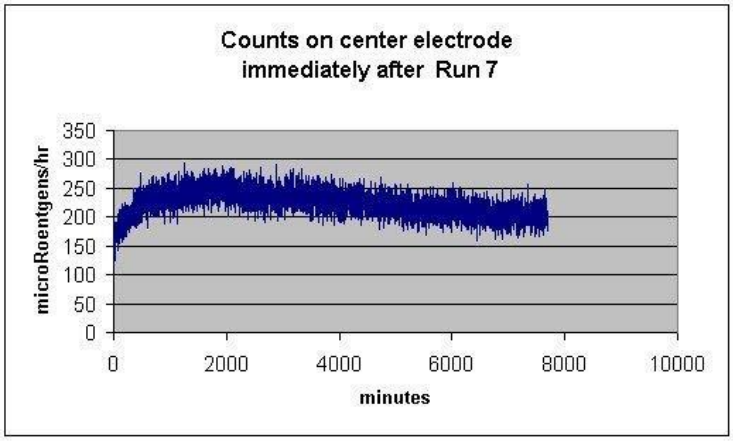
Finally, I did a run where I decided to collect data. The cell ran on thorium nitrate, alternating current, and stainless steel electrodes. After about a half hour, I took the cell apart. I noticed that the curved electrode had a thin layer of glittering, copper colored substance on it. Tiny metallic-looking whiskers were also visible. I decided to place the electrode in front of the counter and see what happened while the liquid portion cooled down.

The counter showed that the dry electrode had significant radioactivity. With this realization, I began to feel kind of depressed. The cell was supposed to get rid of the radioactivity and it clearly had not accomplished that. I laid down for a few minutes to collect my thoughts. I woke up about two hours later. By then the counts per minute had decreased noticeably from about 40 to 30. I knew something significant had happened. Thorium has a half-life of 14 billion years, but now I was watching something decay in just a couple of hours! When I plotted the data, a discernable decay curve showed up:



The graph shows that the emission rate on the dry electrode starts out around 40 counts/minute (equivalent to 40 microRoentgens/hr on the RM-60) then seems to increase briefly, then decays in the pattern of an exponential curve (basically as expected), except that there seems to be some bursty, sawtooth effects as the emission rate approaches the background level (20 counts/min). Although the radioactivity was not gone, it was clearly ***going***, and it was not going to take billions of years either (the passage of 5 half-lives reduces the radiation by $^1/_2{}^5$ or to 1/32 of the original; 10 half-lives would be less than one-thousandth).

Later I ran a cell that contained the brown sludge from the previous run. This was, in effect, my own "radioactive waste" and I just wanted to get rid of the stuff somehow. This time I used direct current along with stainless steel electrodes. The center electrode was the cathode. On runs with AC the center electrode acquired a shiny, electropolished look (industrial electropolishing is done with alternating current; see below for an important application; Use of alternating current reduces concerns about electrode polarization). But this time the center electrode came out black. I decided to put it in front of the counter and see what happened. Here is the plotted data:



This one was even more of a surprise. The counting on the dry electrode began 8 minutes after the electrolysis was shut off. The emission rate starts out at about 150 counts/min and then steeply ***increases*** instead of decreases. It goes up to about 270 and then very slowly tapers off, again in somewhat of a sawtooth fashion. The counting was terminated after about 130 hours. After I plotted the data, I wished that I could have seen the first 8 minutes!

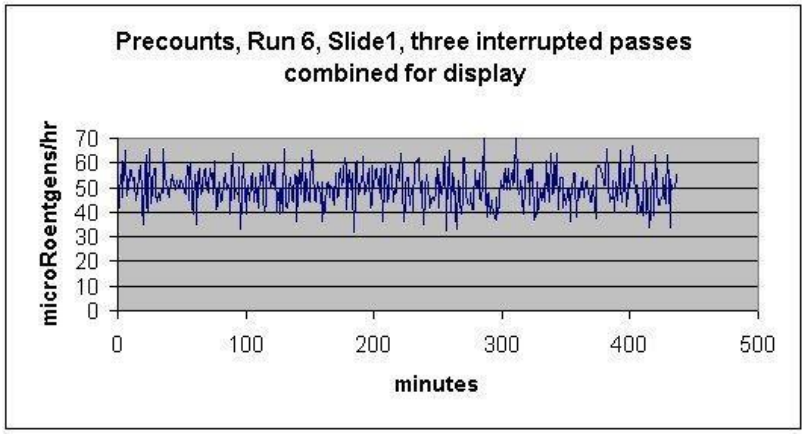
This leads to a working hypothesis that the electrolytic process converts thorium 232 to numerous daughter products. These are radioactive and are neutralized (in parallel) just like the thorium is, as long as the cell is operating. But when the cell is shut off, nothing neutralizes the existing daughter products. A complete radioactive "decay series" then emerges. The short-lived products cause the radiation to increase initially but after they "cook off", the longer-lived ones cause the decay curve to flatten out, although still trending downward.

The results seem to be very similar to those in an experiment by Goddard, Dash, and Frantz done with uranium. They used 10 mg samples and a 3 minute counting window with matched Geiger-Muller tubes:

> "Previously, it has been reported that nuclear transmutation reactions are accelerated when radioactive elements are subjected to low-level electric fields during electrolysis of aqueous electrolytes. . . . Our research investigated the codeposition of U_3O_8 and H on Ni cathodes, using an acidic electrolyte and a Pt anode. Then, the radiation emitted by the electroplated U_3O_8 was compared with radiation emitted by unelectrolyzed U_3O_8 from the same batch. . . . The electroplated U_3O_8 initially produced ~2900 counts in 3 min (April 17, 2000). This rose sporadically in steps to 3700 counts in 3 min on May 11, 2000, and it remained relatively constant at this level until the . . . measurements ended on June 8, 2000. The unelectrolyzed U_3O_8 from the same batch emitted radiation at a much lower rate, ~1250 counts in 3 min, and this remained almost constant over the entire period of measurement." (G. Goddard, J. Dash and S. Frantz, "Characterization of Uranium Codeposited with Hydrogen on Nickel Cathodes", *Transactions of the American Nuclear Society*, **83**, 376-378 (2000)).

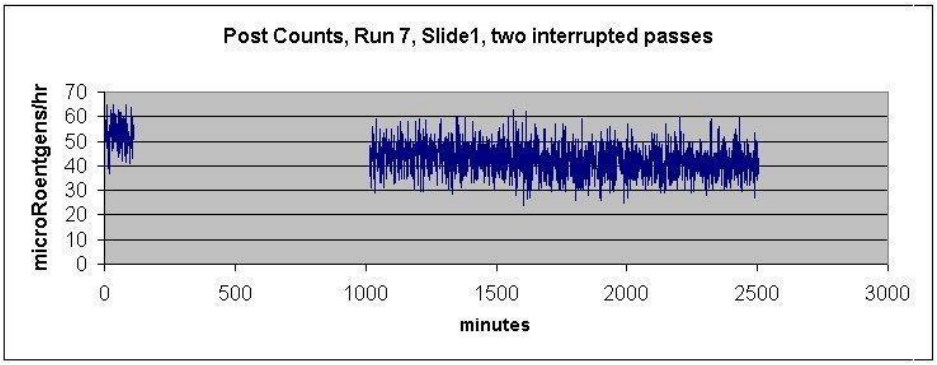
Later they did gamma ray measurements and these showed that, overall, the electrolyzed sample was 1.7 times more gamma emissive than the unelectrolyzed sample.

Of course I still wanted to know what was happening with the copper-colored sludge. The precount slides on unprocessed thorium nitrate tetrahydrate typically show the following pattern:



Note that the counts are around 50 and that the trend of the plot is flat. This is exactly what you would expect. Something that has a half-life of 14 billion years is not going to show a noticeable change in decay rate in several hours. There is no obvious sawtooth pattern either; I had worried that the cycling of the air conditioner could somehow show up on the graphs.

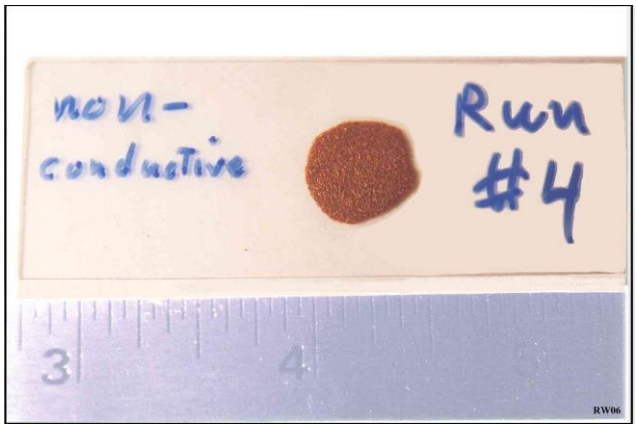
Post counts on the dried copper-colored sludge slide looked like the following:



Here the radioactivity starts out between 50-60 counts/minute (higher than the original 50) but after 1000 minutes has decayed to between 50-40, and at 2500 minutes has decreased to about 40. (During the blank range I was counting a different slide.) A week later the average had dropped to 38. There is still quite a bit of radioactivity present, and it is not decaying as fast as desired. Clearly though, it *was* affected by the electrolytic process, and in a manner similar to the electrode.

After the run with AC and stainless steel electrodes, the liquid looked something like iced tea with copper paint stirred into it. The liquid had tiny, iridescent particles that looked like metal flecks of copper (the same stuff that I saw on the electrodes). They were fascinating to watch as they were slowly swept around in the thermal currents of the slowly cooling liquid. Copper is a transmutation product that has been seen in these kinds of cells. But I had my doubts that this was copper. There was an awful lot of it. If it got there by transmutation, its presence would represent the release of a lot of energy, but none was apparent. Did it all go off as neutrinos (which do not interact with the environment and produce no heat)? Very unlikely. And I could *see* the particles. That meant they must be at least 40 microns in diameter (the limit of unaided vision), and if they were that big and made of metal, they should be settling out of the liquid a lot faster.

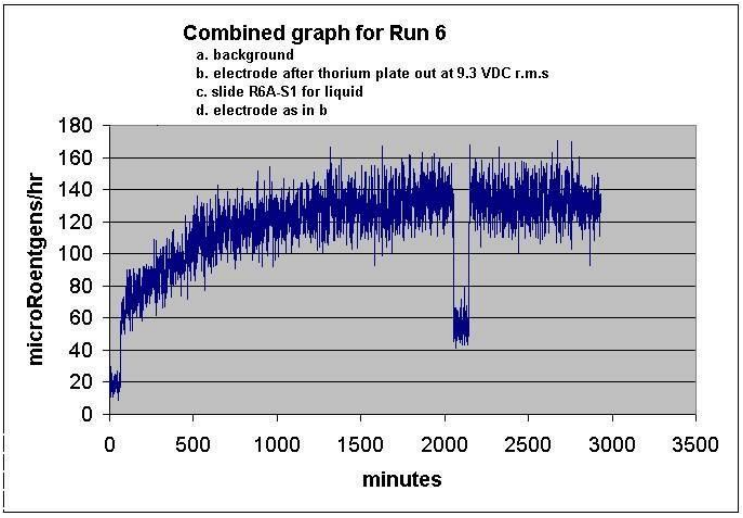
After several hours, the particles had settled out and I removed the "supernatant liquor" with a modified turkey baster. I scooped out a sample of the sludge and dried it on a microscope slide. It looked just like a blob of fine, glittery copper particles:



But it was non-conductive. It could not be copper. (I really don't know what it is. My best guess would be a mixture of thorium and ferric hydroxides, the latter coming from corroded stainless steel electrodes).

"Wherever the tree falls, there it lies." (Ecclesiastes 11:3)

Low Voltage Electrolysis



A different method was used to collect data for Run 6. The counter was started as a background counter and then the dry electrode was placed in the electrode counting fixture directly after the run and while the counter was already operating. The delay to get data was only 2 minutes instead of the usual 8. As expected, the electrode radioactivity increases with time. Later, the RM-60 was moved from the electrode fixture to the slide fixture. Counts on the dried liquid sample imply that quite a bit of the thorium did not plate out and is still in the liquid. The RM-60 was then transferred back to the electrode counting fixture. This scheme helps to reduce any effects of Geiger tube warm up or software initialization.

Tempted to try it yourself?

Students might ask "Can I do this experiment as part of a highschool science or STEM project?" And teachers might view it as a possible project in an honors program. So I am sure such questions will come up. Here are some things to consider.

Remember that one of my purposes here is to show that radioactive decay rates can be affected by a simple electrolytic process, and that this suggests a way of neutralizing radioactive waste that should be promptly and vigorously investigated. I am really not so much interested in students doing these experiments as I am in having parents realize "If my kid can do it, why can't the Department of Energy do it? Why should I have tens of thousands of tons of radioactive waste being shipped through my state? Why should we spend $57 billion on STORAGE of radioactive waste if there might be a way to neutralize it right at the power plant?" As I have explained above, the obstacles to this research are more social and political than technical. The popular press has convinced people, through irresponsible journalism, that this is "junk science". Consequently, universities won't touch it for fear of public criticism and loss of prestige and funding. The government isn't going to listen until they hear that mom and dad are convinced that this kind of research is worthwhile.

Nevertheless, if you decide to try this experiment as a science project, you will of course need adult sponsorship* and professional supervision from your teacher. Your teacher will probably have several suggestions. One will undoubtedly be to use only hardware that is specific to the purpose of the experiment. The equipment in the illustrations is intended for multiple purposes and can be simplified *if you copy the essential principles, not the equipment.* For instance, you can use a nine volt battery for the power supply. This is strongly recommended and will greatly improve safety and reduce equipment complexity. You should also use much less thorium nitrate. If you want to use AC, use a doorbell transformer or one of those little plug-in transformers (the AC type) and give careful attention to electrical safety (including shields, fusing, grounding, GFI protection, and power ratings). You'll need well-shielded and physically stable counting fixtures, and some rudimentary skills with data analysis software like Microsoft Excel. Your teacher might arrange to have operating cells and counters in a locked display cabinet, and might want to handle all radioactive material himself, instead of letting a student do it. Remember that teachers always want to know "What are you going

to learn from doing this?" Be prepared with a list of answers. And finally, PUBLISH YOUR FINDINGS on the Internet (please send me a link) and explain why they are important. (*in many states it is probably unlawful for people less than 18 to work on radioactive materials. Check your state laws and proceed appropriately)

Also, expect a little hysteria when proposing experiments of this type. Parents and teachers are not generally aware that our environment contains radioactive materials like thoriated mantles in the gas lamps that might light your street, thoriated tungsten rods that are used in welding, monazite sand sometimes used in pottery, the tiny amounts of americium in smoke detectors (don't mess with it!), the potassium 40 circulating in your own body, and the equivalent of the 10-20 chest X-rays Americans get every year from ambient radiation. When a clerk at the photo shop saw the photo with the cans of thorium and uranium nitrate (above), I ended up having a little unscheduled talk with the police after I drove home from church. The labels visible in the photos had words like "nitrate", "radioactive", "may cause cancer", "Oxidizer. May cause fires", and so forth. They did not understand the rest of the photos either, and just wanted to know what I was doing. The next day (Monday), there was a lot of publicity about the arrest of a suspect in a radiological bomb ("dirty bomb") plot. I was actually glad that the police had already talked to me.

When people have questions and concerns, try to deal with them as God deals with Christians: "If any of you lacks wisdom, let him ask of God, who gives to all men generously *and without reproach* . . ." (James 1:5). And some words of advice from a guy in government, namely, King Solomon: "He who keeps a royal command experiences no trouble, for a wise heart knows the proper time and procedure" and "If a ruler's temper rises against you, do not abandon your position, because composure allays great offenses." (Ecclesiastes 8:5 and 10:4). "By forbearance a ruler may be persuaded, And a soft tongue breaks the bone." (Proverbs 25:15) Keep a cool, patient head, and maybe those around you will too.

And remember . . . It's an ***adventure!*** Be careful, but enjoy the wonder!

Things to keep in mind

Please keep the following in mind when designing experiments or reviewing those presented above:

1. Before meaningful measurements can be made on electrodes or on a liquid, the electrolysis must be stopped. This is because electrolysis will move the radioactive ions around and change their geometrical relationship with the counter. The radioactive ions may plate out on the cathode, or they may precipitate out of the solution and settle to the bottom of the container. Or bubbles may sweep them to the top and they may stick to the sides like a bathtub ring. If you have the counter looking at an operating reaction cell, you may see a decrease (or increase) in the measured radioactivity, but this may be due to radioactive ions moving to a different location, not because there has been any basic change in radioactivity levels. In fact, this can happen even if the cell is not energized; uranium can self-plate onto an electrode just like copper will self-plate onto an iron nail in a solution of copper sulfate.

2. The geometrical relationship between the counter and the dry electrode (or dry sample) must be fixed and stable. If the counter is looking at a portion of an electrode and then gets bumped, or moved by a wife who wants to "tidy things up a bit", then the results are going to be skewed, and may lead to an unsupportable conclusion. This is why counting fixtures are so important.

3. Total amounts of radiation are NOT measured in these experiments. Instead, the radioactivity of an essentially unknown (but fixed) amount of electrolyzed material is compared with the radioactivity of an unknown amount of *un*-electrolyzed material. *Only the behavior with time* (the *shape* of the decay curve) has any meaning in this setup, not the absolute level of counts. In the experiments shown above, the decay curves of electrolyzed material that satisfied the above two requirements showed either a fast *decrease* in radioactivity, or a gradual *increase* in radioactivity. Virgin, un-electrolyzed material just showed a flat line with essentially constant radioactivity levels. (Amounts are chosen only to give a signal that is significantly above the background level.)

4. Radiation measurements that are done on a liquid with the counter viewing the liquid through the wall of a plastic container will register only beta and gamma counts, with no alpha counts (alpha particles are easily stopped by the water and the plastic). In contrast, measurements on bare, dry material will also register alpha counts besides the beta and gamma counts. (If you run measurements on a liquid, it is a good idea to remove the electrodes, so that there is no possibility of radioactive metal deplating from the electrodes and re-entering the liquid phase.)

Thorium and uranium are used in these experiments for safety reasons, not because people care about neutralizing the radioactivity of these very long-lived isotopes. Similarly, very short-lived isotopes are not of much concern either; the radioactivity from these materials is intense, but burns off to safe levels in just a few days, weeks, or months. The real concern is with the isotopes that have intermediate half-lives of dozens of years to tens of thousands of years. From the human standpoint, these are both intensely radioactive, and intensely persistent. Cesium 137 has a half-life of 30 years; strontium 90, 29 years; radium 226, about 1620 years; plutonium 239 and 240, about 24,000 and 6,537 years respectively. The passage of 20 half-life periods will decrease the radioactivity levels by more than a million. But you can readily see that tens of thousands of *tons* of this stuff is going to remain dangerously radioactive for a long, long time. That is why any simple economical process that affects radioactive half-lives is of great significance. No one will care if you can change the half-life of thorium from 14 billion years to a few days, but if you could change the half-life of strontium 90 from 29 years down to a month or a week, that would have enormous scientific and economic implications. Currently, we do not know if isotopes with intermediate half-lives are more sensitive to electrolytic neutralization than long-lived isotopes. And unfortunately, experiments on these intermediate materials are far too dangerous for the amateur experimenter.

However, see:

"Radioactive half-life experiment, barium-137m" (Thomas Jefferson National Accelerator Facility) http://education.jlab.org/frost/halflife_part1.html http://education.jlab.org/frost/halflife_part2.html http://education.jlab.org/frost/halflife_part3.html United Nuclear Scientific Equipment and Supplies

And here is a partial account about the use of high temperature and electric fields in neutralizing a sample of radioactive Cobalt 60: ("Radioactivity Deactivation at High Temperature in an Applied DC Voltage Field Demonstrated in 1964")

Can I do the same operation with the equipment for a gamma radiating cobalt specimen and get a similar result? A time was agreed to and with Cecil's directions and under his watchful eye I operated the equipment to try to obtain a

similar result. A specimen that had a high active count was selected for the test. Equipment was checked for radioactivity and indicated background levels. The specimen was placed on the pedestal, arc gap adjusted, bell jar was greased and placed on its platform. Electrical connections were checked for the correct polarity, i.e., a negative charge (positive charge for all you electrical engineers) on the pedestal where the specimen was placed. Electrical equipment was switched on for the vacuum pump and for the electric controls to the specimen.

The vacuum pump had to create a reduced pressure in the bell jar for the purpose of creating an electrical arc (3000 volts maximum from the center tap transformer) and thus the heating effect on the specimen once the electrical arc was established and at the same time placing a negative electric field (less than 3000 volts when operating with the electrical arc) on the specimen for deactivation that was placed on the pedestal in the evacuated bell jar. The major concern was obtaining an adequate temperature (critical deactivation temperature) on the specimen by the electric current in the vacuum and power available from the electrical equipment, since it was limited by available electrical power current. The specimen attained a nice orange glow, probably somewhere around 2400 degrees Fahrenheit. Held at temperature for a minute or so and turned off the vacuum pump. The electric arc was then broken as the bell jar lost its vacuum. The heating stopped since the electrical arc was broken. The electrical field was maintained during cool down of the specimen. The electric field was discontinued after the specimen had cooled down and the bell jar was removed.

The Geiger Counter was then used to make radiation measurements. The specimen showed background readings. The result was very few counts as compared to the high number of counts prior to treatment. The pedestal, bell jar, HEPA filter located between the bell jar and the vacuum pump, vacuum hose, and the vacuum pump were still at their initial background readings. The data convinced me that elimination of radioactivity and deactivation/neutralization had occurred for the treated cobalt specimen. ("Radioactivity Deactivation at High Temperature in an Applied DC Voltage Field Demonstrated in 1964". Larry Geer & Cecil Baumgartner, http://www.gdr.org/nuclear_half.htm ; https://patentimages.storage.googleapis.com/ba/e6/fc/e0a66ce218ba29/EP3300082B1.pdf)

None of these simple, crude experiments will completely destroy the radioactivity, even in a small sample. The intent here is simply to point to a line of investigation that could prove very useful. Professional scientists have already done similar experiments with much more complete and convincing results. But they have faced rabid censorship, opposition to their findings, and institutional disinterest.

A few patents follow. US patents can easily be found via http://www.freepatentsonline.com . Non US patents can be accessed via https://worldwide.espacenet.com/ (After Search, click on the underlined title. (Look for a red Patent Translate button if needed). Then Choose "Original Document" and then the Download icon)

WO03098640 Processing Radioactive Material with Hydrogen Isotope Nuclei (John Dash, Oregon State University)

WO9919881 Low Temperature Electrolytic Nuclear Transmutation (Miley-Patterson)

A method for producing low temperature nuclear transmutations by electrolysis in an aqueous media. New elements produced by transmutation are identified as having discrete peaks in occurrence by atomic number (Z) and by atomic mass (A). New complex nuclei produced by transmutation are idendified as having existed based upon the nature and occurrences of fission transmutation elements produced. The electrolytic cell (12) includes a non-conductive housing (14) having an inlet (54) and an outlet (56) and spaced apart first and second conductive grids (38 & 44) positioned therein. A plurality of cross-linked polymer non-metallic cores each having a uniform conductive exterior metallic surface formed of a high hydrogen absorbing material form a bed (35) of conductive beads (36) closely packed within the housing (14) in electrical contact with the first grid (38) adjacent the inlet (54). An electric power source (15, 16) in the system (10) is operably connected across the first and second grids (38 & 44).

US2003202623 Low-Cost Elimination of Long-Lived Nuclear Waste
US20040238366 Method and system with apparatus for acceleration of activity decrease and radioactive material deactivation
US5076971 Method for enhancing alpha decay in radioactive materials
WO9740211 System, Electrolytic Cell And Method For Producing Excess Heat And For Transmutation By Electrolysis (Patterson)

WO9803699 Nuclear Transmuted Elements Having Unnatural Isotopic Distributions By Electrolysis And Method Of Production (Patterson,-Miley
RU2052223 Method For Producing Stable Isotopes Due To Nuclear Transmutation, Such As Low-Temperature Nuclear Fusion Of Elements In Microbiological Cultures
DE19803629 Transmutation of Isotopes with Long Half-Life
RU2210630 Facility For Generation Of Gas Mixture And Transmutation Of Nuclei Of Atoms Of Chemical Elements

A more extensive list of patents can be found at http://www.rexresearch.com/fukushimamour/fukushima.htm

"Mining" of high-level radioactive waste

It is well known that the fission process produces many other elements, some of which are quite valuable. Removal of the radioactivity in the "spent fuel" makes these newly created elements more accessible:

> "When nuclear fuel is irradiated in a power reactor a wide range of chemical elements is created by the fission of uranium and plutonium.These fission products include palladium, rhodium and ruthenium, and could in principle constitute a valuable source of these three metals. "Recovery of Platinum Group Metals from High Level Radioactive Waste", R. P. Bush, *Platinum Metals Rev.*, 1991, 35, (4); ; See also: http://en.wikipedia.org/wiki/Synthesis_of_precious_metals ; http://pubs.acs.org/doi/abs/10.1021/ie900265y ; http://www.wmsym.org/archives/2001/55/55-4.pdf

Additionally, the neutralization process itself produces still other elements, and apparently the various processes can be adjusted to favor particular nuclides. The tens of thousands of tons of high level radioactive waste could become a valuable resource instead of a deadly environmental hazard.

Special yarn could help communities clean up radioactive waste.

> "Federal health officials agree radioactive waste in St. Louis area may be linked to cancer" https://www.cbsnews.com/news/radioactive-waste-cancer-federal-health-officials-acknowledge-possible-link/
>
> "The radioactive wastes from that processing were then stored at sites in North County. Tens of thousands of barrels, many stacked and left open to the elements, contaminated the soil and nearby Coldwater Creek. It's the creek that sometimes flooded the park next to the Oscko's house.
>
> . . . Dyken and her colleagues did find distinct potential risks. For children who grew up near Coldwater Creek, or lived in its flood plain for many years in the 1960s to the 1990s, the risk of some cancers may be higher, in particular for bone and lung cancers."

The Federal government has various ways to clean up radioactive waste. Here is a potential one that is not yet in use:

> "Seawater yields first grams of yellowcake: Yarn-like material collects largest amount of uranium to date", Susan Bauer (June 13, 2018) https://phys.org/news/2018-06https://phys.org/news/2018-06-seawater-yields-grams-yellowcake-yarn-like.html - jCpseawater-yields-grams-yellowcake-yarn-like.html#jCp

"Material designed to capture uranium from seawater as an alternative to land-based mining of the fuel for nuclear power production is tested at PNNL's Marine Sciences Laboratory. Credit: PNNL"

This method should work for any heavy metal waste (radioactive or not) dissolved in water. Radioactive material can be collected and then destroyed using the methods outlined above.

"Technology makes storing radioactive waste safer", 31 October 2011, http://www.qut.edu.au/about/news/news?news-id=37568

> "Professor Huai-Yong Zhu from QUT Chemistry said the world-first intelligent absorbent, which uses titanate nanofibre and nanotube technology, differed from current clean-up methods, such as layered clays and zeolites, because it could efficiently lock in deadly radioactive material from contaminated water.
>
> The used absorbents can then be safely disposed without the risk of leakage, even if the material became wet."

Extending radioactive half-lives might also be useful

The focus of the above article has been on *reducing* the half-lives of radioactive materials, especially nuclear waste, in order to render it safe for disposal. However, an opposite kind of technology might also be possible: a technology to *extend* the half-lives of radioisotopes. There are three reasons this should be investigated:

1. **Extending the shelf life of valuable medical radioisotopes might be possible.** Technetium 99m is widely used in nuclear medicine for "functional" diagnostic medical imaging. It has a half-life of 6 hours. This is long enough for functional studies, but short enough so that the residual radioactivity is not a nuisance (people in an airliner don't like sitting next to a slightly radioactive former patient). Because of the short half-life, the Tc-99m has to be produced just before use, usually offsite in a molybdenum 99 generator. The Tc-99m, of course, decays during transport to the hospital. Costs would go down and convenience improved if such isotopes could be prepared, purified, and preserved in a special environment that makes such radioisotopes stable.

2. **Studies of elements at the upper end of the Periodic Table might be possible.** Elements at the upper (heavy) end of the Table from about polonium, element #84, to the unnamed element #118, show generally increasing instability. They either eject mass in the form of alpha particles, or simply split in two (fission). The ability to create and preserve such elements indefinitely would greatly facilitate studies of these heavy elements.

3. **Demonstrating that half-lives can be altered artificially has deep geochronological and cosmological implications.** Suppose the Earth at one time had all the elements of the Periodic Table and that they were all stable (non-radioactive). Then suppose some process occurred on a time span of millions of years, and with increasing intensity, that caused the heavier elements to become radioactive. Elements at the upper end of the Periodic Table would begin disappearing. Perhaps several thousand years ago this process began to affect polonium, which until that time was a stable element. This could explain the mystery of "parentless" polonium radiohalos such as those in Gentry's careful studies that have been used to support the "instant Earth hypothesis" advanced by Creationists. Some references:

Examining Radiohalos, R. H. Brown, H. G. Coffin, L. J. Gibson, A. A. Roth, and C. L. Webster, Geoscience Research Institute, Origins 15(1):3238 (1988), Literature Review: Creation's Tiny Mystery, R. V. Gentry. 2nd ed. (1988). Earth Science Associates, Knoxville, Tennessee. 347 pages. https://www.grisda.org/origins-15032 https://archive.org/details/creationstinymys0000gent

"Diamonds: a creationist's best friend, Radiocarbon in diamonds: enemy of billions of years", by Jonathan Sarfati http://creation.com/diamonds-a-creationists-best-friend

Also, (in case you are wondering) the Bible says: "In the beginning God created the heavens and the earth." (Genesis 1:1). The time is indefinite and could easily have been millions of years or longer for the creation of the *physical* heavens and earth. The preparation of the (already existing) earth for habitation took six Creative Days. God rested on the seventh Day, but there is no scriptural statement that the seventh Day ever ended. On the contrary, it seems to have continued down to our time (Hebrews 4:3-6, 9), and this implies that a Creative Day is at least 6000 years long.

And while we are at it, please note that the earth was worked over by water on *two* occasions, not one. The first was the waters of Creation, (Genesis 1:2) which probably converted the "surface" of the earth from a pile of rocks (like those evident on Mars and Venus and asteroids) into something that was more like fine grit. This was a cyclic process likely taking thousands of years and the end result would be layers and layers or rock strata extending deep into the earth.

The other was the Flood of Noah's day (Genesis 7 & 8). Its aftermath cut deep channels into the earth, exposing the rock strata, which is visible in places like the Grand Canyon (Arizona) and in deep mines.

Both events need to be taken into account when trying to determine the ages of rock strata.

Natural radioactive decay rates might not be constant. In fact, we have studied radioactive decay on earth for only about 100 years, and still do not understand what actually causes radioactivity. Isotope geochronology (ages of rocks, planets, stars, etc.) is based on this limited knowledge and extrapolates it out to ***billions*** of years and applies it to things that are far outside of our experience. If I did something like that, I would be accused of promoting "junk science"!

Observed natural variations in radioactive decay rates

Researchers believe they have seen variations in the radioactive decay rates of silicon 32, chlorine 36, manganese 54, radium 226, and possibly plutonium 238. The variations are typically a few tenths of one percent and seem to correlate with the yearly variations in Earth-Sun distance. The scattered quotes below are from "Half-Life (more or less)", by Davide Castelvecchi, *Science News*, Nov 22, 2008, p. 20-23:

> " . . . when researchers suggested in August that the sun causes variations in the decay rates of isotopes of silicon, chlorine, radium, and manganese, the physics community reacted with curiosity, but mostly with skepticism."
>
> "Both experiments had lasted several years, and both had seen seasonal variations of a few tenths of a percent in the decay rates of the respective isotopes."
>
> "In those experiments, the decay rate changes may have been related to Earth's orbit around the sun, the Purdue teams says. In the Northern Hemisphere, Earth is closer to the sun in the winter than in the summer. So the sun may have been affecting the rate of decay, possibly through some physical mechanism that had never before been observed."
>
> "The closer to the sun, the denser the shower of neutrinos."
>
> "If the results are confirmed, and nuclear decay is not immutable, perhaps physicists could find a way to speed it up to help get rid of waste from nuclear power plants."

"About 7 percent fewer solar neutrinos hit detectors when Earth is furthest from the sun, compared with when it's closest, says Arthur B. McDonald, director of the Sudbury Neutrino Observatory in Ontario." *Science News*, Vol 160, No. 8, August 25, 2001, p. 115

See "Evidence for Correlations Between Nuclear Decay Rates and Earth-Sun Distance", J. H. Jenkins, *et al*. Available online at http://arxiv.org/abs/0808.3283 ; "The strange case of solar flares and radioactive elements", Stanford University, https://phys.org/news/2010-08-strange-case-solar-flares-radioactive.html

"Is the Sun emitting a mystery particle?", Ian O'Neill, 2010, https://www.nbcnews.com/id/wbna38863989

> However, when they compared their measurements with other scientists' work, the values of the published decay rates were not the same. In fact, after further research they found that not only were they not constant, but they'd vary with the seasons. Decay rates would slightly decrease during the summer and increase during the winter.
>
> As the Earth is closer to the sun during the winter months in the Northern Hemisphere (our planet's orbit is slightly eccentric, or elongated), could the sun be influencing decay rates?
>
> In another moment of weirdness, Purdue nuclear engineer Jere Jenkins noticed an inexplicable drop in the decay rate of manganese-54 when he was testing it one night in 2006. It so happened that this drop occurred just over a day before a large flare erupted on the sun. . . .
>
> The sun link was made even stronger when Peter Sturrock, Stanford professor emeritus of applied physics, suggested that the Purdue scientists look for other recurring patterns in decay rates. As an expert of the inner workings of the sun, Sturrock had a hunch that solar neutrinos might hold the key to this mystery. Sure

enough, the researchers noticed the decay rates vary repeatedly every 33 days -- a period of time that matches the rotational period of the core of the sun. The solar core is the source of solar neutrinos.

It may all sound rather circumstantial, but these threads of evidence appear to lead to a common source of the radioactive decay rate variation. But there's a huge problem with speculation that solar neutrinos could impact decay rates on Earth: *neutrinos aren't supposed to work like that*.

"'Scientists don't know why': Cesium-137 in soil near Chernobyl has half-life of 180 to 320 years, not 30 years as is typical", http://enenews.com/scientists-don%e2%80%99t-know-why-cesium-137-in-soil-nearchernobyl . . . ; http://www.wired.com/wiredscience/2009/12/chernobyl-soil/ https://abcnews.go.com/Technology/chernobyl-exclusion-zone-radioactive-longer https://abcnews.go.com/Technology/chernobyl-exclusion-zone-radioactive-longer-expected/story?id=9374383expected/story?id=9374383

"Radiometric Dating: Is the 'Decay Constant' Constant?", Anderson, John Lynde & George W. Spangler (1974), Pensée, No. 4 (Fall 1974), 31-33.

"Serial statistics: Is radioactive decay random?", Anderson, J.L.and G.W. Spangler, 1973, Phys. Chem. J., 77 (26) : pp. 3114 - 3121.

"Fine structure of histograms of alpha-activity measurements depends on direction of alpha particles flow and the Earth rotation: experiments with collimators", Simon E. Shnoll, Konstantin I. Zenchenko, Iosas I. Berulis, Natalia V. Udaltsova, Ilia A. Rubinstein, submitted 1 Dec 2004, http://arxiv.org/abs/physics/0412007

If "solar neutrinos impact decay rates on Earth", this should not be hard to investigate with spacecraft. Equip interplanetary space probes with matched radioactive samples and matched radioactivity detectors (appropriately shielded from everything except neutrinos). Send one to Mercury and another to Mars (or where-ever). There will be a big difference in solar neutrino flux at different distances from the Sun, and therefore a change in decay rates should be easily detected and easy to predict.

Here is another radiometric anomaly: "Przybylski's Star" http://en.wikipedia.org/wiki/Przybylski's_star

In 1961, the Polish-Australian astronomer Antoni Przybylski discovered that this star had a peculiar spectrum that would not fit into the standard framework for stellar classification.[12][13] Przybylski's observations indicated unusually low amounts of iron and nickel in the star's spectrum, but higher amounts of unusual elements like strontium, holmium, niobium, scandium, yttrium, caesium, neodymium, praseodymium, thorium, ytterbium, and uranium. In fact, at first Przybylski doubted that iron was present in the spectrum at all. Modern work shows that the iron-group elements are somewhat below normal in abundance, but it is clear that the lanthanides and other exotic elements are highly overabundant.[5]

Przybylski's Star also contains many different short-lived actinide elements with actinium, protactinium, neptunium, plutonium, americium, curium, berkelium, californium, and einsteinium being detected. The longest-lived isotope of einsteinium has a half-life of only 472 days. Other radioactive elements discovered in this star include technetium and promethium.[14]

How is it that short-lived radioactive atoms appear in the atmosphere of stars? Apparently, there are regions of space where the neutrino flux is so low that all the atoms of the Periodic Table are stable against radioactivity, including the ones beyond uranium. *(Beyond Einstein: non-local physics, 6th ed* https://www.academia.edu/118513535/Beyond_Einstein_non_local_physics_6_th_ed p. 93, 128)

But there is another explanation. In non-local physics, atomic mass is categorized into two types. One type is the mass equivalent of twice the atomic number ("primary mass"). Conventionally, it is regarded as a proton + neutron combination. The other, which is conventionally ascribed to "excess" neutrons, is "secondary mass". This latter mass has an equilibrium condition with the local neutrino

flux which produces a “zone of stability” of atoms that are not radioactive, but which have a mass of more than twice the atomic number.

After a very long time, a star will finally enter the supernova stage and blow itself to bits. This drastically changes the density of its matter, and the previously existing neutrino flux density drops drastically in intensity too. One of the products will be a white dwarf star which has matter of very high density; this is caused by an effect known to non-local physics as excess time displacement. A neutrino is essentially a unit of rotational space and can readily move into this region of excess time (a ratio of space to time is motion). An analogy would be opening a bottle of ammonia; the ammonia molecules diffuse into the newly available “excess space”, and this will lower the original concentration in the bottle. In a like manner the neutrinos diffuse into the newly available excess time. This upsets the previous neutrino/atomic decay equilibrium and will cause the previously stable equilibrium (“zone of stability”) to move to a new equilibrium point closer to twice the atomic number. This results in new radioactivity which did not previously exist.

Excess time displacement has yet another effect. Normally atoms of high atomic mass gravitate downward to the center of the star. Consequently, they are *not* seen in abundance in the atmosphere. But with excess time displacement a star can cause “inside-out” gravitation, and this will cause atoms of high atomic weight to move *upward* into the star’s atmosphere. There may even be an observable stratification effect due to differences in atomic weight. This is apparently the case with Przybylski's Star:

> Instead, Przybylski found lots of other elements in his weird star: strontium, lanthanum, cerium, praseodymium, neodymium, europium, gadolinium, terbium, dysprosium, holmium, erbium . . .
>
> Now, these things should be only present in the tiniest of abundances, not the most easily seen lines in the atmosphere! What’s going on?
>
> The answer seems to be levitation, although it appears we still don’t have a great model for it.
>
> . . . the bottom line is that the ions of a certain element get concentrated in a thin (or at least high) layer in the atmosphere. If this layer is high enough, we see it in absorption and the element looks *much* more abundant than it really is (because we usually assume the atmosphere is well mixed, not stratified). And if this layer is low enough, we might not see the element at all!
>
> So that’s apparently what puts the “p” in “Ap,” the *bulk* star does not have weird abundances, but its *upper atmosphere* does because the upper layers of the star are differentiated and stratified!
>
> But that’s not what’s so weird about Przybylski’s star. No, that star doesn’t just have weird abundance patterns; it has *apparently impossible* abundance patterns. In 2008 Gopka et al. reported the identification of *short-lived actinides* in the spectrum. This means radioactive elements with half-lives of order thousands of years (or in the case of actinium, *decades)* are in the atmosphere. [https://ui.adsabs.harvard.edu/abs/2008KPCB...24...89G/abstract]
>
> https://sites.psu.edu/astrowright/2017/03/15/przybylskis-star-i-whats-that/
> https://sites.psu.edu/astrowright/2017/03/16/przybylskis-star-ii-abundance-anomalies/

“Chemically peculiar stars” **(** https://en.wikipedia.org/wiki/Chemically_peculiar_star)

> In astrophysics, chemically peculiar stars (CP stars) are stars with distinctly unusual metal abundances, at least in their surface layers.
>
> These processes cause some elements, particularly He, N and O, to "settle" out in the atmosphere into the layers below, while other elements such as Mn, Sr, Y and Zr are "levitated" out of the interior to the surface, resulting in the observed spectral peculiarities. It is assumed that the centers of the stars, and the bulk compositions of the entire star, have more normal chemical abundance mixtures which reflect the compositions of the gas clouds from which they

formed.[1] In order for such diffusion and levitation to occur and the resulting layers to remain intact, the atmosphere of such a star must be stable enough to convection that convective mixing does not occur.

"HD 87240 is a chemically peculiar star with an overabundance of heavy elements, study suggests"
https://phys.org/news/2018-10-hd-chemically-peculiar-star-overabundance.html

Analysis of UVES data allowed the team to determine chemical abundances for 39 elements in the atmosphere of HD 87240. The astronomers found that this star is significantly overabundant in heavy elements, especially when it comes to platinum (Pt) and mercury (Hg) – about 10,000 times the solar abundances.

Moreover, HD 87240 was found to be unusually rich in silicon (around 10 times the solar abundance) an in the so-called rare-earth elements like cerium (Ce), praseodymium (Pr) and neodymium (Nd) – at a level of at least five times the solar abundances.

A star with inverted gravitation is not stable in the spatial system. Over a long period of time, it will repeatedly "burp" ("recurrent nova" is the technical term) as the matter moves to a new gravitational equilibrium.

Inverted gravitation is certainly an interesting topic in its own right, as is excess time displacement. But its only relevance here is that it can reveal the existence of short lived radioactive atoms in stars that are presumably millions of years old. For those who believe that radioactivity rates are essentially immutable or "constant", this is something that demands an explanation outside of conventional ("local") physics.

Temperature has unexpected effects on radioactivity

"Thirty years ago, Otto Reifenschweiler was searching for a compound which could protect Geiger-Mueller tubes from damage when they are first ionised. He found the compound, which became a money-spinner for Philips, in a mixture of titanium and radioactive tritium. He also discovered that as the mixture was heated, its radioactivity declined sharply. No process known to physics could account for such a baffling phenomenon: radioactivity should be unaffected by heat. Nevertheless, as the temperature increased from 115°C to 160°C, the emission of beta particles fell by 28%." ("High temperature supresses radioactive decay", *Science Frontiers*, Mar-Apr- 1994, http://www.science-frontiers.com/sf092/sf092c14.htm ; Physics Letters A ("Reduced radioactivity of tritium in small titanium particles," Vol. 184, pp. 149-153; see also http://www.infinite-energy.com/images/pdfs/MalloveIE54Radio.pdf)

"The 'Reifenschweiler effect' is the observation that the beta-decay of tritium half-life 12.5 years is delayed reversibly by about 25-30% when the isotope is absorbed in 15 nm titanium-clusters in a temperature window in between 160-275 C. Remarkably at 360 C the original radioactivity reappears. The effect is absent in bulk metal. Discovered around 1960/1962 at Philips Research Eindhoven, The Netherlands Reifenschweiler extensively discussed his observation with o.a Casimir (the director of research at the time), Kistemaker (ultracentrifuge expert), and although no satisfactory explanation was found, R. was allowed to publish it. At the time a unique example as to how an electronic environment might affect nuclear phenomena." (http://pages.csam.montclair.edu/~kowalski/cf/311alberts.html)

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"A contribution from R. Monti described the suppression of the radioactivity of thorium oxide. Monti's method was similar to the method worked on in the summer of 1992. He could reduce the activity from 900 cpm to about 100 cpm in four days of a series of sudden heatings.

Possibilities of de-naturing radioactive wastes appears and have been further developed by Monti and separately by Hal Fox (2003)." http://www.lenr-canr.org/acrobat/BockrisJthehistory.pdf "The History Of The Discovery Of Transmutation At Texas A&M University", J.O'M. Bockris, Molecular Green Technology, College Station, Texas 77845, Revised Version, 6th of August, 2003

"A cool solution to waste disposal", *Physics World*, Edwin Cartlidge (2006)
http://physicsworld.com/cws/article/news/2006/jul/31/a-cool-solution-to-waste-disposal

"Cool solution to waste disposal" (2006; Claus Rolfs, Ruhr University)
http://phys.org/news73578268.html

> "The group has investigated this hypothesis by embedding a number of radioactive nuclei inside metals and then cooling the metal to a few degrees kelvin. As expected, they observed a longer half-life for the electron capture of beryllium-7 and shorter halflives for β+-decay in sodium-22 (*Eur. Phys. J.* A 28 251) and α-decay in polonium-210. They are now investigating the α-decay of radium-226, a hazardous component of spent nuclear fuel with a half-life of 1600 years. [Claus] Rolfs calculates that this half-life could be reduced to as little as a year and at the very least to 100 years, and believes that the half-lives of all other hazardous alpha emitters within nuclear waste could be shortened by similar amounts."

"Do Nuclear Decay Rates Depend on Temperature?"
https://www.technologyreview.com/2009/10/27/208571/do-nuclear-decay-rates-depend-on-temperature/

> In the last few years, however, a number of new results have threatened to overturn this picture. Various groups have shown that the rate of alpha, beta, and electron capture decays all depend on temperature and whether they are placed in an insulating or a conducting material. That's exciting because it raises the possibility of treating radioactive waste products. But it also raises a problem for particle physicists whose entire standard model assumes that decay rates cannot be influenced by external factors.
>
> The anomalous results are puzzling. One group found that the alpha emitter polonium-210, when placed in a copper container at 12 degrees Kelvin had a half-life that was six percent shorter than at room temperature. Another report claimed that the half-life of the beta(-) emitter, gold -198, was 3.6 percent longer at 12 degrees Kelvin than at room temperature. And yet another group showed that the half-life of beryllium-7, which decays by electron capture, depends on the material in which it is placed, increasing by 0.9 percent in palladium at 12 degrees Kelvin and at 0.7 percent in indium at 12 degrees Kelvin. There is even a theory to explain what is going on: that a temperature-dependent screening effect inside metallic containers influences electron capture. This, of course, ought to affect all nuclei that decay in this way.

See also:

"Half-life heresy: Accelerating radioactive decay",
https://www.newscientist.com/article/mg19225741-100-half-life-heresy-accelerating-radioactive-decay /

Transmutation of long lived radionuclides to short lived radionuclides

"The Road to Remediation of Radioactive Waste? Mitsubishi Heavy Industries Proceeds Toward Practical Research" (Nikkei, April 8, 2014 by Yoshikazu Miura):

> "Mitsubishi Heavy Industries has established technology based on a low-energy nuclear reaction concept of the transmutation of elements. For example, the transmutation of cesium was experimentally confirmed to increase, by an atomic number of four, to praseodymium, without the use of a large-scale nuclear reactor or accelerator.
>
> The company is moving from a fundamental research stage into a practical research stage. Their technology may open the path to clean nuclear transmutation technology. Mitsubishi Heavy Industries, a primary manufacturer of nuclear technology, is eager to use the technology in a practical application to convert radioactive strontium and cesium waste into harmless non-radioactive elements."

(Refs: "Nuclide transmutation device and nuclide transmutation method", EUROPEAN PATENT SPECIFICATION EP 1 202 290 B1 http://www.freepatentsonline.com/EP1202290B1.pdf
http://news.newenergytimes.net/2014/04/24/nikkei-reports-mitsubishi-to-use-lenrs-tohttp://news.newenergytimes.net/2014/04/24/nikkei-reports-mitsubishi-to-use-lenrs-to-clean-nuclear-waste/clean-nuclear-waste/

Radiometric dating anomalies

"The conflict for radiometric methods is that zircons in Precambrian granite display huge helium concentrations [15]. When the amounts of uranium, lead, and helium are determined experimentally, one finds amounts of lead and uranium consistent with more than a billion years of nuclear decay at presently measured rates. Amazingly, most of the radiogenic helium from this decay process is also still present within these crystals that are typically only a few micrometers across. However, based on experimentally measured helium diffusion rates, the zircon helium content implies a time span of only a few thousand years since the majority of the nuclear decay occurred.

So which physical process is more trustworthy -- the diffusion of a noble gas in a crystalline lattice or the radioactive decay of an unstable isotope? Both processes can be investigated today in great detail in the laboratory. Both the rate of helium diffusion in a given crystalline lattice and the rate decay of uranium to lead can be determined with high degrees of precision. But these two physical processes yield wildly disparate estimates for the age of the same granite rock. Where is the logical or procedural error? The most reasonable conclusion in my view is that it lies in the step of extrapolating as constant presently measured rates of nuclear decay into the remote past. If this is the error, then radiometric methods based on presently measured rates simply do not and cannot provide correct estimates for geologic age.

But just how strong is the case that radiometric methods are indeed so incorrect? There are dozens of physical processes which, like helium diffusion, yield age estimates orders of magnitude smaller than the radiometric techniques. Many of these are geological or geophysical in nature and are therefore subject to the question of whether presently observed rates can legitimately be extrapolated into the indefinite past. . . . "

There are other processes which are not as easy to express in quantitative terms, such as the degradation of protein in a geological environment, that also point to a much shorter time scale for the geological record. It is now well established that unmineralized dinosaur bone still containing recognizable bone protein exists in many locations around the world [17]. From my own first hand experience with such material, it is inconceivable that bone containing such well preserved protein could possibly have survived for more than a few thousand years in the geological settings in which they are found." "Highlights of the Los Alamos Origins Debate", John R. Baumgardner, Ph.D. (and Nicholas Petersen)
https://www.icr.org/research/index/researchp_jb_debatehighlights/

"Transmutations of radioactive isotopes?", Ludwik Kowalski, 2004,
http://pages.csam.montclair.edu/~kowalski/cf/186radwaste.html

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Piezonuclear reactions

"Piezonuclear decay of thorium", Fabio Cardonea, Roberto Mignanib, Andrea Petrucci, *Physics Letters A*, Volume 373, Issue 22, 11 May 2009, Pages 1956–1958 (http://www.sciencedirect.com/science/article/pii/S0375960109004113)

Abstract
"We show that cavitation of a solution of thorium-228 in water induces its transformation at a rate 10^4 times faster than the natural radioactive decay would do. This result agrees with the alteration of the secular equilibrium of thorium-234 obtained by a Russian team via explosion of titanium foils in water and solutions. These evidences further support some preliminary clues for the possibility of piezonuclear reactions (namely nuclear reactions induced by pressure waves) obtained in the last ten years."

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"Piezonuclear neutrons from fracturing of inert solids", F. Cardone, A. Carpinteri, G. Lacidogna (March 2009) (https://arxiv.org/abs/0903.3104)

"Neutron emission measurements by means of helium-3 neutron detectors were performed on solid test specimens during crushing failure. The materials used were marble and granite, selected in that they present a different behaviour in compression failure (i.e., a different brittleness index) and a different iron content. All the test specimens were of the same size and shape. Neutron emissions from the granite test specimens were found to be of about one order of magnitude higher than the natural background level at the time of failure."

See also Piezonuclear Reactions, arXiv:1009.4127 (Sept 2010)

Use of asymmetric alternating current in charging/plating/polishing

I inadvertently came across a long overlooked patent that describes a method of suppressing dendrite formation during battery charging. These finger-like growths lead to premature battery failure. The method is essentially an integrated combination of conventional charging and electro polishing. It suppresses dendrite growth, produces a smoother, denser electrode, and is faster than conventional charging.

"Process and apparatus for renewing exhausted primary, more particularly dry, electric cells or batteries," Ernst Beer, June 26, 1956. (http://www.freepatentsonline.com/2752550.pdf)

From the original patent, http://www.freepatentsonline.com/2752550.pdf :

" . . . a current is passed through the cells or batteries to be treated, consisting partly of alternating current and the remainder of direct or pulsating direct current. For charging or renewing normal commercial cells or batteries, the treating circuit can therefore include a rectifier with a very considerable leak (50-90%) or a rectifier bridged by a resistance. . . . Experiments with dry hearing aid batteries and pocket lamp batteries have shown, that by a treatment according to the invention the life of such batteries can be lengthened to 20 to 30 times the normal life."

The process was originally intended for *primary* batteries, which were not intended to be recharged. This technology comes from the 1950s and can easily be done today, even by hobbyists (or as a science fair project). Wouldn't you like to have rechargeable batteries that last 20-30 times normal? Do you think that there would be a market for such a charger? Especially for car batteries . . .? For home power plants . . .? For exploding lithium batteries . . . ?

Some interest by NASA:

". . . it is well known in the plating field that periodic current reversal methods can plate coatings at a much faster rate than can be done by conventional direct current methods. It is further known that the reverse-current part of the charging cycle will tend to act as a depolarizer. Use of this technique should lead to significantly higher battery charging rates. Furthermore, a problem with dc chargers is that the electrode material is plated on as a loose, spongy mass which often falls off and ultimately leads to battery failure. The current characteristic of this battery charger is similar to that used in electropolishing circuits and because of this characteristic, electrode material should be replated as a smooth, hard surface (ref. 1), thereby contributing to increased reliability and long life." (Brief Investigation of an Asymmetrical Alternating-Current Battery-Charging Technique by Donald J. Vargo): https://www.scribd.com/document/701347677/Brief-Investigation-of-an-Asymmetrical-Alternating-Current-Battery-Charging-Technique

"Why High-Energy Batteries Fail and Start Fires
Engineers get the first close-ups of finger-like growths that trigger battery failures.
Machine Design, Stephen Mraz | (Dec 12, 2017) http://www.machinedesign.com/materials/why-high-energy-batteries-fail-and-start-fires

Links

http://lenr-canr.org/wordpress/?page_id=187 Shows lots of very detailed color photographs and drawings of cold fusion cells. Also has article "High School Students Do Cold Fusion" which is about the work Prof. John Dash (Portland State University) with high school students as part of the Apprenticeships in Science and Engineering program.

"Fun with fusion: Freshman's nuclear fusion reactor has USU physics faculty in awe" http://deseretnews.com/dn/view/0,1249,510054502,00.html (Sept 2003)

"Take water and potash, add electricity and get - a mystery", By Robert Matthews, Science Correspondent https://www.telegraph.co.uk/news/uknews/1430416/Take-water-and-potash-add-electricity-and-get-a-mystery.html

http://rexresearch.com/eccles/1eccles.htm (WO 00/25320 patent info)

https://www.popsci.com/science/cold-fusion-low-energy-nuclear-reaction/

https://www.freepatentsonline.com/5273635.pdf

http://www.amasci.com/weird/anode.txt

COLD FUSION BY PLASMA ELECTROLYSIS OF WATER
http://guns.connect.fi/innoplaza/energy/story/Kanarev/coldfusion/

CR-39 alpha detector chips and electrolysis of Li_2SO_4
https://www.sciencedirect.com/science/article/abs/pii/S0168900221001145

http://pubs.acs.org/cen/science/87/8749sci2.html ("Tribology All Around", Mitch Jacoby, Chemical & Engineering News, December 7, 2009): https://cen.acs.org/articles/87/i49/Tribology-Around.html

> The team found that unrolling tape at a relatively slow rate—just a few centimeters per second—simultaneously leads to visible light and X-ray emission from the spot that the tape separates from the roll. They showed that the X-rays are intense enough to image the bones in a finger by exposing commercial dental X-ray film to the tape-peeling apparatus for about 1 second. Further study revealed that this tribological process induces nanosecond bursts of X-rays with a peak energy of about 15 keV.

Beta Glucan can improve radiation exposure survival rates
http://www.betaglucan.org/R-Z.htm ,

"Technology makes storing radioactive waste safer", 31 October 2011,
http://www.qut.edu.au/about/news/news?news-id=37568

> "Professor Huai-Yong Zhu from QUT Chemistry said the world-first intelligent absorbent, which uses titanate nanofibre and nanotube technology, differed from current clean-up methods, such as layered clays and zeolites, because it could efficiently lock in deadly radioactive material from contaminated water.
>
> The used absorbents can then be safely disposed without the risk of leakage, even if the material became wet."

Deinococcus radiodurans (https://en.wikipedia.org/wiki/Deinococcus_radiodurans)

"Deinococcus radiodurans is an extremophilic bacterium, one of the most radiation-resistant organisms known. It can survive cold, dehydration, vacuum, and acid, and is therefore known as a polyextremophile and has been listed as the world's toughest bacterium in *The Guinness Book Of World Records*. . . . As a consequence of its hardiness, it has been nicknamed Conan the Bacterium.

D. radiodurans is capable of withstanding an acute dose of 5,000 Gy (500,000 rad) of ionizing radiation with almost no loss of viability, and an acute dose of 15,000 Gy with 37% viability. A dose of 5,000 Gy is estimated to introduce several hundred double-strand breaks (DSBs) into the organism's DNA (~0.005 DSB/Gy/Mbp (haploid genome)). For comparison, a chest X-ray or Apollo mission involves about 1 mGy, 5 Gy can kill a human, 200-800 Gy will kill *E. coli*, and over 4,000 Gy will kill the radiation-resistant tardigrade.

Deinococcus has been genetically engineered for use in bioremediation to consume and digest solvents and heavy metals, even in a highly radioactive site."

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Articles by Brian Fraser:

"Beyond Einstein: non-local physics, 6 th ed"
https://www.academia.edu/118513535/Beyond_Einstein_non_local_physics_6_th_ed

Beyond Einstein: non-local physics, 5 th ed
https://www.academia.edu/94182990/Beyond_Einstein_non_local_physics_5_th_ed
https://vixra.org/pdf/2401.0119v1.pdf

Atom Or Nucleus
https://www.academia.edu/45461890/Atom_Or_Nucleus

Basis for Scriptural Physics
https://www.academia.edu/45268861/Scriptural_Physics

Research needed on monopolar pulsed high voltage levitation
https://www.academia.edu/29945834/Research_needed_on_monopolar_pulsed_high_voltage_levitation
https://vixra.org/abs/2405.0071

Intuitive Concepts for Atomic and Photon Spin Systems
https://www.academia.edu/107963701/Intuitive_Concepts_for_Atomic_and_Photon_Spin_Systems_2_nd_ed
(to be revised)

https://www.academia.edu/106049631/Does_a_spinning_mass_have_reduced_inertia_compared_to_the_same_mass_in_an_unspun_state

Stealth Communism: an exercise in perception