How to Build a Dirac Current Positron Generator

by
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NB: You can read this essay as science fiction or science fact. It's up to you.

First Some Theory

One of the most elegant forms of ZPE devices is the Dirac Current Positron Generator. Once you can finesse the low energy generation of positrons from the quantum vacuum, letting nature supply the bulk of the energy requirement for the task, you then can release large amounts of usable "free energy" by simply letting the positrons annihilate with electrons under controlled conditions. So here are some suggestions that may contribute to the building of a Dirac Current Positron Generator, and its companion antimatter drive -- one of the major engines of the future and a marvelous source of clean energy.

First we'll consider the fundamental principles, the theory, and then we'll look at technology available to actualize the goal of a positron generator.

The positron is a positive electron. Some people call it antimatter, and some people like to think of it as an electron going backwards in time. Both viewpoints are correct. But there is more to the story.

Back in 1928 Paul Dirac, one of the developers of quantum mechanics, proposed that the equations of QM suggested the possibility of the existence of antimatter. Matter and antimatter would be separated by a gap of 2 Mo c^2, where Mo is the rest mass of one particle. Shortly thereafter the positron, or antielectron, was discovered. This was one of the great predictions of modern science that became a reality.

A puzzling feature of the positron was that, according to the theory, there should be as many positrons as electrons. But no one knew where the other positrons were. They learned to create a few positron-electron pairs in the laboratory by using photon energy > 2 Me c^2 or >1.02 M eV (where Me is the mass of an electron), but these positrons would quickly annihilate with electrons and disappear, releasing their 2 Me c^2 or 1.02 M eV.

Dirac proposed a model -- the Dirac Sea -- to explain his theory of antimatter, but this model still did not really explain what happened to the positrons that should balance the electrons we experience all around us. I remember reading about the Dirac model many years ago and envisioning it as a Chinese checkerboard in which the electrons were marbles and the positrons were holes in the board.

When electrons are in their true vacuum n = 0 ground state (below the lowest n = 1 orbital), they enter the Dirac Sea and are invisible to us. When an electron is excited, it pops out of its hole in the Checkerboard Sea and rolls around. Due to relativity the hole where it was tucked away also appears to move around as if it were a "particle". In the period right after the Big Bang there were lots of electrons and positrons zipping around in the high energy cosmic soup, but after the Big Ball expanded and cooled below the energy threshold for popping out of the checkerboard, almost all of the electrons dropped into their holes and annihilated with their partner positrons, releasing lots and lots of photons in a great flash that we still detect as the cosmic background radiation in the Great Dirac Energy Sea.

Unfortunately that story still doesn't explain why some electrons unaccountably hung around to participate in the physical universe or where the other positron holes went. Why didn't they all find partners and annihilate? Are they hiding in some far-off corner of the universe? If so, how did they get there?

In my book, Observer Physics: A New Paradigm, I explain what happened in detail, but for our present discussion we can just go back and look closely at Dirac's clever model to see the basic answer hiding right there.

Electrons occur in two states, free and bound. The bound electrons move in orbitals around atoms. Because the electrons are wiggling all the time (why they wiggle is an interesting discussion), the bound electrons have to follow strictly quantized orbitals or quickly decay, which they obviously don't do. So Dirac showed a kind of quantum ladder on which the electrons could climb a rung at a time out of the Sea. These rungs correspond to orbitals. Each higher rung represents a higher state of excitation. We find that if an electron gets excited beyond a certain level, it seems to leave the orbital state, and it becomes a free electron. When this happens we say that the atom has ionized because the part left over ends up with a positive charge once the negatively charged electron leaves. Actually the electron is never really free. It just reaches an orbital that becomes non-local. The non-local orbital is shared by all the atoms, so a "free" electron can be captured by any ionized atom that it encounters.

To go to higher orbitals requires absorbing energy in the form of photons, and dropping to a lower orbital involves emitting photons. The photons are therefore like an accounting device to keep track of which orbital an electron is at. You don't have electrons without photons or vice versa. They are a single package.

Now, coming back to the Dirac model, we can see very clearly where all the missing positrons are. As the electron releases photons and drops to lower and lower orbitals, it draws closer and closer to the nucleus of an atom. Why? Well, the nucleus has a positive charge. Why? Because the nucleus has at least one proton (hydrogen) and protons are positively charged. Nobody bothers to explain why protons are positively charged.

If there's smoke, there's probably fire. What this situation tells me is that there is at least one positron inside a proton. That sounds crazy. Why doesn't the proton annihilate like an unstable particle? For example, look at positronium -- a quasi atom formed by the momentary conjunction of an electron and a positron whirling around like a tiny binary star system. Positronium is unstable and quickly poofs back into photons. Well, one thing this tells us is that electrons and positrons are made of nothing but photons somehow in a stable spinning mode. (We won't pursue that interesting topic in this discussion. Observer Physics covers it.)

Somehow the proton has achieved a stable configuration. And so has the electron. They both have lasted for billions of years. They are as close as you can get to perpetual motion machines. Why don't they wear out or decay?

The electron is a "point" particle, but the proton is an "ensemble" particle. Current theory says a proton is made of three quarks. But that ain't all, folks. We get a clue when we look at the proton's alter ego, the neutron. In a nucleus the protons and neutrons oscillate with each other all the time, swapping identities. Furthermore, the neutron by itself is unstable and decays, emitting an electron and an antineutrino. This tells us that the electron orbiting a monatomic hydrogen atom is not really in its lowest state. It has a lower state, a kind of $n = 0$ orbital and energy state inside the neutron. The neutron releases the electron to pop out when it lacks the extra charge of a second proton nearby to help hold it in. The internal electron actually orbits between the proton and the neutron in a much closer orbit than the 1-s orbital. When a neutron leaves an atomic nucleus, its positive core doesn't have enough charge. So an internal orbiting electron flies away (plus an ANTIneutrino -- a tattletale clue to nucleonic antimatter), and the "ionized" neutron (now decayed into a proton) then captures a low-energy electron into its "ground state" 1-s orbital and becomes hydrogen. Then it joins another hydrogen atom to make a relatively stable diatomic hydrogen molecule. The whole nucleus system does not really reach its most balanced "ground state" until we get to the naturally monatomic inert gas, helium.

It turns out there are actually TWO positrons inside a proton, plus an internal electron and some neutrinos in addition to the three quarks. Since electrons are magnetic tops (spin 1/2), they feel more magnetically balanced when they are in pairs (1/2 plus 1/2 = 1), so the two suborbital electrons inside a neutron must form a Cooper pair, which also means there must be two positrons in there to balance the charges. The quarks (and some neutrinos) act as buffers to keep the positron-electron pairs from annihilating as they do in positronium. Thus we could say the positronium quasi-atoms are "skinny" protons that have lost their quarks and become unstable. (The details of these structures and the amazing explanation of why the proton is so stable are covered in Observer Physics.)

Take a look at a chart of the hadrons. They are all unstable except for the proton, and the light baryons are more unstable than the light mesons are. Why are mesons made of particle-antiparticle pairs, but the baryons have no antiparticle components in the standard theory? Nobody asks that obvious question. Probably they figure: well, if there were an antiparticle in the proton, it would be unstable. Then why are the other baryons unstable but the heavier atoms are stable all the way up to the radioactive series? I think the heavier baryons are unstable because, like mesons, they have antiparticle components. The main difference between baryons and mesons is that baryons have three quarks plus a following of leptons and the mesons only have two quarks. So the real issue is how the proton gets to be so stable in spite of having positrons in its core.

According to Observer Physics (and modern QM) the subatomic particles are not solid objects like billiard balls. They are all incredibly dynamic energy systems. To give a feel for the proton' s basic dynamics, I suggest you go to the bathroom. Run water into the washbasin until some accumulates, and then adjust the tap so that the inflow just balances the outflow. If your drain is not too sluggish or the wrong size and placement relative to the tap (it works better if the taps are off-center from the drain), you should notice that a vortex forms over the drain. Observe closely, and you will see the vortex is a standing wave that generates a hole in the water. You will usually see a large bubble form over the hole. In our analogy the water in the basin represents the quark mass-energy. The hole in the center represents a positron.

We have to imagine that the water that goes down the drain gets pumped back into the basin via the tap. The pump to the tap represents an electron. Nobody ever explains where the energy that pours out of an electron comes from. How can an electron exhibit charge and not decay? Well, now you know. The energy cycles around from the positron in the center of the proton. The electron energy tap moves energy primarily through ordinary space and secondarily through time, and the positron drain moves energy backward through a space/time tunnel to the birth of an electron-positron pair from the vacuum.

In Observer Physics I give a precise description of how the photonic energy moves through the electron and positron vortexes. Although these leptons are for most purposes "point" particles, the energy does have a finite distance to travel from the singularity to the radiation point event horizon and follows an exact space/time trajectory. The dynamics of these leptons involves the physics of black holes, white holes, Hawking radiation, and more. There' s a lot to explore here.

We can produce electron and positron pairs from the vacuum in a variety of ways that all require mass-energy equivalent to the mass-energy of the pair of particles in order to ensure conservation. Virtual pair production and annihilation goes on spontaneously all the time everywhere in the vacuum generating virtual quantum bubbles. If we zap a pair out of the vacuum with a burst of energy, the partners usually quickly recombine, annihilate, and release their mass-energy again as photons. Such interactions are real quantum bubbles. Conservation always is maintained as the energy of particles loops around in space/time. However, since all electrons look alike, a positron might choose to annihilate with a different electron than her original creation partner. In this case the overall space/time trajectory looks like an electron zig-zagging in time. But sooner or later every electron finds a partner positron and together they wink out with a flash.

We can represent all this simply in a Feynman space/time diagram that has a horizontal axis representing one dimension of space, and a vertical axis showing the dimension of time. A pair production bubble looks like a vesica pisces (football shape) standing on one pointy end. The two particles emerge from the vacuum, spread apart, and then merge together again, disappearing back into the vacuum. The vesica outline is made of two warped vectors that link head to tail at each end. The electron half of the loop moves upward along the time axis, and the positron half moves downward.

Suppose we have a situation where the two particles are held relatively stationary -- close, but apart, and blocked somehow from re-merging. They would form a standing wave in which the energy flowed around the loop as EM exchanges, but the particles appeared to stay relatively "still" in space, the pair drifting upward on the time axis like a bubble rising in a pond.

For example, on our diagram the forward time-travelling electron might point upward and just slightly to the left in space. The backward time-travelling positron would point downward in time and slightly to the left in space (relative to an observer, and to its own right relative to itself), meeting the tail of the electron vector. Instead of the pair reuniting in space after some time to annihilate in a big poof of photons, they get stuck at a certain spatial separation and keep going through time with a leakage of energy along the 45-degree light-speed axis to (try to) complete the energy loop. Energy flows forward in time with the electron, then radiates photons at light speed forward in time to the positron, and then flows backward in time along the positron space/time vector to the creation point. The pair becomes stuck in a space/time loop and continues exchanging EM energy like this as they move up the time axis in parallel. This loop can continue for billions of years and may end only in a Gnab Gib.

From Theory to Application: Building the Dirac Current Positron Generator

Now that we have some background in theory, let's explore some possible ways to invent a working Dirac Current Positron Generator (dcPG).

The first principle we need to note is that, in QM, particles are not solid fixed objects. They are wave functions of probability. A particle only looks like a particle when you decide to look at it to see where it is and what it is doing. The wave aspect of matter means that a "particle" is really non-local by nature. This discovery led to developing remarkable new quantum technologies. One of these is the quantum well, or electron trap. You can create a little box that will trap and hold prisoner a single electron. However, the electron can always escape by tunneling out of his cell. By changing the environment in subtle ways you can manipulate the probabilities of the electron to stay put or escape. Under one condition he's overwhelmingly certain to stay put, and under another condition he's overwhelmingly certain to escape. We can represent this graphically by drawing a box and then drawing a wave that passes right through it, extending onward in both directions. When the wave is pretty flat, the electron is effectively "gone". When the wave has a big bump arising inside the box, the electron is in his cell. A bump in the wave can arise outside the box and you know the electron is at large. The bump represents high probability density. This technology has already been embodied and may become a cool-running, superfast computer flip-flop. You can' t get any smaller and faster with a material digital device than with a single electron. The next step is purely optical processing.

But we want to make a positron, not an electron. So now imagine that we set up an array of these electron traps. Do you start to see a resemblance to the Dirac Sea model? When an electron is in its quantum cell, it is like an electron trapped inside a neutron or in a hole in the Dirac Chinese Checkerboard Sea. We might imagine that the cell itself is playing the role of a positron in the Dirac Sea. Actually that is not quite correct. The array of cells is closer to what we call the "zero point". It does not have the level of negentropy of an antiparticle.

If the electron in a quantum cell is a bump in a wave located inside the cell box, a positron in a quantum cell would be an "antibump" located inside the cell box. To get a real positron, we need to generate antibump probabilities inside the quantum cells, or perhaps next to the cells. We need positron probability density.

Let' s draw a Feynman diagram to help us see more clearly what we want, and then look at a possible technology to get the results we want.

Our goal is to create an unpaired positron directly from the vacuum with very little effort. As we observe the diagram from above, the time-reversed positron travels downward and to the left on our Feynman diagram. This means it moves backward in time and more or less across some small spatial distance. The tail of the positron vector junctures with the head of an electron vector and creates an antizig in time. The electron vector moves as a particle upward and to the left until it meets the tail of the positron vector. At this point the "detached" observer moving in time along the vector pattern sees a flash of photons -- a release of energy -- as the particle pair annihilates at the vertex where the two meet. That' s the "Free Energy" we are looking for!!! To meet the requirements of the conservation law, we must draw another vector from the head of the positron vector to the tail of the electron vector. Then we have a nicely conserved mass-energy loop in space/time.

This third vector can be horizontal -- parallel to the spatial axis or nearly so. It represents a space-like displacement of mass-energy. Since it is instantaneous in time and spread out over space non-locally, you will not see a flash in this part of the diagram. It will be like the cosmic background radiation, very diluted in space. But the total energy spread out in space at the moment of nonlocal pair production will add up to the flash at the pair's timezig vertex when they annihilate, just like the weak 3 K microwave cosmic background radiation, summed for the whole universe, adds up to the hot flash when most of the electron-positron pairs annihilated in the bowl of cosmic soup shortly after the Bang.

By the way, all of these vector loops also have hidden antiloops that represent the same process as it occurs in the consciousness of the observer. When a photon emitted by an electron is absorbed by an electron in your observing eye, you perceive a photon event. This perception involves the sending of a space/time-reversed antiphoton attention particle (advanced particle-wave) from your eye to the object of attention. All lasers and phase conjugation processes demonstrate that that is how it really works. The conjugate photon-antiphoton pair travel together. But from the observer viewpoint, it looks like you see a photon that was emitted in the past. That observation actually "collapses" the wave function across any distance of space, meaning that when you look at a galaxy billions of light years away, you are actually modifying it billions of years ago. You are rewriting the history of the universe every time you look up at the night sky.

Now we have a blueprint showing us how to generate positrons right out of the vacuum and then annihilate them under controlled conditions to get all the Free Energy we might ever need. The principle looks solid, and there's no reason why it shouldn't work with the right technology. So let's hustle over to the lab now and see what we can do. Many readers will be handier and more up-to-date in this department than I am. But here are a few suggestions to get the ball rolling.

Because we generate our positron at the highly nonlocal mass-energy vector side of the Feynman diagram, with our attention and operation focused at the positron vector-head vertex, the mass-energy of the creation stroke is spread out over a large space of the environment. We are operating deliberately in the spatial dimension of the loop with special attention on the positron vector head and the uncollapsed spatial wave function that connects quantum mechanically to a distant electron out there somewhere in the vacuum, as demonstrated by EPR, Bell, Aspect, etc. What we are doing here is similar to running the classic EPR experiment in reverse. We do not need to exert a lot of energy to get things going. Since all electrons are essentially identical, we don't need to know where the converging electron will come from. It will condense out of the vacuum somewhere at the moment we initiate the process of condensing a positron and will end up being the particle that annihilates with our positron to give us usable energy.

Think of the condensation of water vapor into clouds and then rain when the air cools. In a gradual, gentle manner we are going to squeeze a highly dispersed blob of vacuum mass-energy until it condenses into a positron "raindrop" and an electron raindrop. This pair will coalesce into a flash of energy at the annihilation point in space/time under our direction. We are doing a teeny tiny imitation of a Gnab Gib (reverse Big Bang.) We can use a lens, a wave guide, or a cooling process. We need a way to temporarily and relatively locally reverse entropy -- a legal process in QM and classical physics, although once we go past the annihilation flash and any work it accomplishes, we end up with a net increase in entropy overall, and even locally. A laser's resonant cavity etalon shows how we can generate amplification of a QM state into a focused space over an interval of time. Bracket the horizontal vector on our Feynman diagrammed mass-energy loop bubble with a Fabry-Perot type etalon resonator. Unfortunately the laser operates well under unity because of the energy needed to pump the population into inversion in order to initiate the cascade of stimulated emission. So for all its elegance a laser is really a brute force technology.

Condensation suggests cooling. If we cool the space/time in the area where we want mass-energy to condense, we have another way to reverse the entropy in the interaction region. Because of the small size of positrons, the area inside our loop does not have to look very big from our scale. Nature has ways of generating local negentropy to output large amounts of "free energy". An example is a star, which is a gravity sink in the vacuum that spontaneously condenses hydrogen until it fuses into helium releasing brilliant starlight as a side effect. Because gravity is so weak, it takes a lot of space and a lot of hydrogen to get the fusion effect. So it's not an efficient approach at our particular scale of living, though we can and do feed off the starlight from a distance. The fusion researchers are trying to repackage that free energy process at our scale. It's a bit tricky, but it can be done. So keep at it.

Consider a bore tide. I think it's in the bay of Fundy that a very mild tidal flux becomes a giant wave when squeezed by its own momentum into the funnel-shaped channel of the bay. We set up a converging wave guide and allow an imperceptible virtual probability flux to travel "longitudinally" into it through time -- holding the wave guide orthogonal to the wave front. As the quantum flux moves along the time dimension, its probability magnifies and condenses into a real particle pair with real-world mass-energy that can be harnessed through pair annihilation. You see the parallel to the way stars form. All such processes work the same basic way with the same basic Feynman loop structure.

Now here is something else to consider. The primary "mass" of a proton consists of up and down quarks. So each proton is surrounded by a cloud of virtual pions. Pions are 2-quark meson combinations such as ud_, du_, uu_, dd_. (The letters with the underscore represent antiquarks.) This alone tells us right off the bat that there are antiquarks involved in the proton structure in addition to the positron core. There are also virtual antiprotons next to protons, but their probability wave function is much weaker than that of the lighter pions. So it's easier to generate pions and they are common critters in particle accelerators. Observer Physics suggests some simple modifications to quark theory that upgrade the standard notation and clarify many fuzzy issues around the quark interactions.

Although we have a ready source of positrons inside the protons, the protons are cleverly constructed so they are very stable. So to take the complex proton ensemble apart is a bit tricky. Electrons, on the other hand, are naturally surrounded by a handy cloud of virtual positrons. These positively charged positrons are attracted by the negative charge of the electron and the fact that they are the electron's natural antimatter partner. If we are going to pull positrons from the vacuum, we ought to put attention on a space where the probability of the occurrence of a positron is as high as possible and where it's easily accessible. Virtual positrons are boiling in and out of the vacuum everywhere, but their probability density is highest right next to a real electron. And electrons are both stable and plentiful. To pull a positron-electron pair out of a pure vacuum takes > 2 Me c^2 or around 1.02 M eV, but if we only need to pull a positron out, then we only need half that amount. We let nature contribute the electron partner from its vast Dirac Vacuum Sea. So for an input of > 1 Me c^2 (>.51 M eV) we get an output of 2 Me c^2 (1.02 M eV). That's a nice gain.

Each electron is like a little energy fountain -- or stabilized mini white hole -- in the vacuum, gushing EM energy in all directions. Like water flowing downhill, this energy outpouring tends to flow toward the real positrons that reside inside nearby protons, or toward any other positively charged particle, including the virtual positrons that gather about the electron like bees attracted to pollen. Unfortunately these convenient virtual positrons are so diluted in space that they can not survive as real particles. They are like ghosts without bodies. Furthermore, if one did suddenly manifest -- a tiny but finite probability -- it would spontaneously annihilate with the electron it was next to. We want a controlled reaction.

Simply stated, the technical problem is to amplify the virtual positron probability density that occurs next to an electron until it becomes a real particle. Then we control the growth rate and reaction process so the positron annihilates with an electron partner where and when we choose, thus giving us a burst of usable energy.

The laser principle (light amplification by stimulated emission of radiation) was first identified by Einstein as the possibility of deliberate stimulated emission of photons from excited orbital electrons. It took over fifty years for this idea to become embodied in technology. Sometimes it takes time to get from an idea to an embodied reality. (Hey, this is another example of our paradigm -- going from an ideational wave of probability to a physical object via passage through time!) Einstein's idea was that if you pass a photon of the right wavelength past an excited atom, you can stimulate that atom to release its extra energy in step with the stimulating wavelength. Now let's think of an electron as a proto-nucleus with shells of virtual positrons around it similar to an atom with its electrons. Just as orbital electrons must have discrete energy quanta, the "orbital" positrons will have specific probability quanta governed by their vibratory nature and their spatial relation to the electron around which they hover as standing probability waves. Under certain conditions, such as when the electron is very isolated and can't share its charge with anything nearby -- say when it is locked in a quantum cell -- its positronic probability quanta will be more excited, and thus more amplified. At this point we introduce a second probability wave that matches the excited probability quantum that is arising by the electron. This is stimulated quantum probability enhancement. You see the parallel with Einstein's stimulated emission principle.

One way to get this is to squeeze two or more such probability-excited electrons closer together so their positron probability waves overlap constructively. Perhaps we cool electrons to the condition of a Bose condensate in a superconductor (sc). Then a whole raft of electrons functions as a single macroscopic electron. This is our first stage of magnification. A room temp sc would take no energy to maintain. At present we have sc's that stay operational when cooled below 125 K with liquid nitrogen. We start with the "super-real" exaggeratedly improbable monster Bose condensate electron generated by our sc. It has a very large surface whose adjacent vacuum space is filled with excited standing positron probability waves. With this initial condition we can juxtapose several such superconductors to get their positron probability quanta to overlap in phase. This is the second stage of probability magnification. Proper manipulation of superconducting materials to get overlapping virtual fluxes "probably" will give us a generous stream of positrons arising just outside the superconductors like gas molecules bubbling from an electrode in electrolysis. Resonant cavity design engineering may further enhance the effect. The superconductor condensers exclude incursion of magnetic fields into them (via the Meissner effect) just like a single electron does, but outside in the domain where the positrons are condensing there can be a magnetic tube guide that will drive the manifesting positrons as a "Dirac Current" (we' ll use dc instead of DC) into an annihilation "furnace" where they can do a disappearance dance with electrons and release the particle-pair mass-energies they carry. The magnetic tube can be made of a specially prepared permanent magnet or an efficient solenoid. Some of the energy gain can be utilized for any power needed to cool the sc' s and/or maintain the dc magnetic tube, but it should be less than the annihilation output. If everything is permanent solid-state hardware, it may take no energy input at all to run it. The whole system could run entirely on space/time geometry!!

The big question remaining is: how do we effortlessly get the "extra" electrons to appear from the vacuum and annihilate with the positrons? Assuming we can get our dc going, what keeps it from running down and stopping after a while? The monster Bose condensate electron represents a huge collection of electrons frozen into a single macroscopic electron. This is a remarkable property of bosons that is different from fermions. Fermions act as individuals and bosons act as a collective entity. One of the truly profound breakthroughs of QM was the discovery that everything has a Bose-Einstein nature and a Fermi-Dirac nature. One of the "natures" usually predominates under certain conditions. But, under altered conditions, the predominant nature will change. Electrons usually behave as fermions, but show strong boson behavior in a Bose condensate. Actually, they are trying to get into Cooper pairs all the time in atoms and molecules, and do so if permitted. Stable molecular structures are able to hold together by virtue of the tapping into the bosonic tendency inherent in all fermions. When that tendency is turned off, elegant molecular structures fall apart into random collections of fermionic dust particles.

The Bose condensation of the electrons into a single quantum macrostate has "artificially" depleted the electron count in the local environment. So the environment will compensate by allowing a corresponding number of virtual electrons to materialize randomly in the vacuum at some distance from the Bose condensate and thereby restore the balance. What is nifty about our process, though, is that we can "freeze" the sc condensate into a permanent steady state much like the frozen positrons that are stuck inside the protons or like concubines sequestered in a harem.

The sexless quark eunuchs insulate the sexy positrons so the poor horny bachelor electrons nearby just can' t get in close enough to mate with them and go out in the orgasmic glory they desire. So the charged up electrons do the next best thing and go into "mental" fantasies and complex ritual patterns. That generates EM fluxes and molecular structures that weave a complex web around the protons. A kind of "civilization" emerges with a wonderful variety of long-lasting sublimation rites.

In outer space you automatically have an ideal low-temperature environment to keep your sc' s in operating mode. So that plus photon drives takes care of subluminal propulsion needs around the solar system. On earth we need our 77 K liquid nitrogen coolant for a little while, but not for long. In a hydrogen atom energy flows from the electron to the proton and from the proton back to the electron. Though the electron is attracted to fall into the proton, the non-null value of its ground state plus the quark buffer keep it dancing just outside its cherished goal. So we get a perpetual standing wave in the vacuum called hydrogen. This space/time energy loop can last for billions of years just like the endless free energy cycle of water evaporating from the ocean and then falling back as rain. Energy circulates endlessly in the loop of this standing wave until something intervenes from the outside, such as a fusion reaction or an encounter with antihydrogen. Molecular bonds just allow fancier loops.

We use our stable high temp sc' s to set up a similar arrangement. Because the electrons that are sucked out of the vacuum by the Bose condensate in our Dirac Current Positron Generator keep getting annihilated with positrons in our furnace, the electron imbalance in the environmental vacuum is perpetuated indefinitely as long as the dcPG is on and keeps up its dc flow of positrons. "On" means putting the probability functions in phase. "Off" means shifting them out of phase. So our Dirac current of positrons keeps flowing from the turned on sc' s to the furnace through our magnetic channel, and electrons keep manifesting in the vacuum and moving into the furnace all along their own random pathways, like an endless stream of moths drawn to a candle.

Finally, we have one other very important consideration. We must look for an example in nature of the time-reversed version of our process. Our triangular loop looks like a pair production-annihilation bubble cut in half. The middle half is the part where the pair is spread out in space. The two vertexes mark the points in time when the pair appears from vacuum energy and when the pair disappears back into vacuum energy.

If we turn out triangular loop upside down, we have an energy event that produces a positron-electron pair. The pair of particles evolves "upwards" along our time dimension and the two partners separate some distance in the spatial dimension. Then, at some point in time, their probability wave function gets suddenly diluted until they both shift from real particles back into virtual particles, even though they are separated spatially. Therefore the energy exchange must tunnel in a space-wise manner via some mechanism. To an observer the spatial side of the loop will be undetectable, or nearly so, because it is spread out over the spatial interval.

Since we are generating our positrons with Bose condensed sc's, the obvious place to look for a time-reversed triangle mechanism is in the preparation of the sc material. Sure enough we find that the sc at higher temperature is an ordinary conductor, so its conducting electrons are behaving as fermions. When we cool the sc below its critical temperature, the conducting electrons condense into a single macroscopic Bose state. This means that many electrons are now behaving as one. This means also that the many electrons have effectively had their probability waves diluted until they behave like quasi virtual electrons. The individual electrons are still there, but they behave as if they were virtual particles. So the conducting electrons in an sc give us a look at "real virtual" particles.

The dilution of electron probabilities means that there must be a corresponding dilution of positron probabilities in order to maintain equilibrium. How can that happen if there are no positrons around? Well, Observer Physics tells us that there ARE real positrons in the vicinity, and they are spatially separated from the diluting electrons so that they can not annihilate. We find them in the cores of the protons of the sc atoms. In other words, the formation of an sc material should induce some of the positrons in the protons to wink out and return to the vacuum, thereby causing proton decay. If it induces positrons elsewhere, they will most likely annihilate right away with electrons, and this is the process we are encouraging as a Positron Generator function. But, when the external positrons annihilate, that reestablishes the imbalance. Also, the positrons are locked up pretty well in the quantum wells that we call protons. The only way they can get out is to tunnel. Thus the most likely event is the condensation of stable real electrons somewhere outside the Bose condensate to make up for the ones that "dilute" their fermion probability inside the condensate. This is equivalent to saying that a large blob of probability on the wave function of a conducting electron in a condensate tunnels out of the condensate and hops onto a virtual electron in the boiling vacuum and makes it real.

Nevertheless there is also a finite probability that something will happen to the positrons inside their proton cells. The electrons involved in the superconducting phenomenon are only the Drude gas electrons in the conducting bands. Although the superconductor material has equal numbers of electrons and positrons if it is electrically neutral overall, the nuclei of the atoms forming molecules that form the sc material contain many times more protons than the number of electrons that participate in the Bose condensate. Each proton (and neutron) also has two positrons, so they would tend to wink out in pairs, in the same way the electrons are linking up via phonons to form Cooper pairs during the condensation process. Nevertheless, we should see a tendency for some of the atoms in the sc material to decay from time to time -- more often than in ordinary matter. This decay should occur primarily during the phase transition at the critical temperature. The decay releases some energy in the form of decaying quarks, plus some beta particles and a few antineutrinos, but that mixes in with the heat that is extracted in the cooling process. If an atom splits, you may have some alpha particles and neutrons coming out, all of which can be detected. Although the number of decaying atoms may be too few to detect by assay, there may be a brief spurt of radioactivity as the material passes through the phase transition into the Bose condensate condition.

During the operation of our Dirac Current Positron Generator, there may also be a tendency for the real positrons in the protons of the sc to lend their probabilities to the condensation of positrons in the constructively interfering probability wave space. This means that occasionally a real proton-core positron might tunnel out of the sc into the positron probability production zone, causing another proton (and hence another atom) to decay. This tendency would be muted by the rapid annihilation of the condensed positron stream as it enters the furnace. At any one time, there would be only a certain average number of positrons in the condensed state outside of the protons. However, if we stored the positrons in a magnetic bottle and allowed them to accumulate, we could generate a significant drain on the positrons in the sc material. This in turn would lead to a noticeable number of atoms in the sc material decaying. The particular decay routes would be dictated by the type of atoms used in the sc material.

In any case the tendency to proton decay in the sc is irreversible and has a finite probability to occur every time we turn on the device during the time it takes to "prime the pump" by building up the stream of positrons in the magnetic tube to the furnace. It stops once the positrons begin annihilating in the furnace. Thus the sc's in a dcPG will wear out after a certain amount of use. When enough protons decay, the structure of the sc will be disrupted to the point that it will no longer function effectively as an sc. You will then have to replace it with a new one and recycle the old one. Fortunately the proton decay is not 1:1 with the positron condensation, since electrons pulled from the vacuum will balance most of the positrons.

We can further enhance the positron condensation tendency by techniques that encourage the nucleonic positrons to tunnel some of their probability into the condensation zone. For example, we can use permanent magnet fields to make a wave guide that also urges the positrons from the condensation zone into the tube. We can also use techniques similar to the remarkable laser cooling of Rb atoms. (Baierlein, p. 207-208) You can see from these methods that, depending on various factors, only part of the proton positrons will tunnel out into the zone. The rest will condense directly from the vacuum.

Thus we see in this Dirac Current Positron Generator an astounding possibility of demonstrating in the laboratory under controlled conditions the long-sought phenomenon of proton decay. The notion that in this model we have discovered not only a method for stimulated positron emission but also a method of stimulating proton decay opens up another whole realm of exploration. If protons can condense from the cosmic soup, there must be a mechanism to dissolve them even if they are extremely resistant to decay. The simple analogy for this is that we can force extremely stable atoms into isotope form under the proper conditions. Another analogy is the reverse beta decay of protons into neutrons that occurs naturally in the special environment of white dwarf stars.

Will the ability to induce proton decay endanger the world? Could you have a runaway chain reaction that causes the physical universe to decay? I doubt it. You can relax. It's not the end of the world. Only under special conditions such as in a room temperature sc or in a material cooled below its critical point can such things occur. The process requires a lot of negentropy, which is not widely available in our entropic environment. Thus, proton decay is not likely to happen on any scale unless Gnab Gib type conditions prevail. Then the protons will naturally dissolve back into the quark soup. But the Dirac Current Positron Generator technology should enable us to demonstrate in the lab the reality of the phenomenon of proton decay.

Considering the parallels of my proposal with laser technology, phase conjugation, wave mechanics, and the myriads of methods by which these related processes are induced these days, I'll be surprised if there aren't many creative ways to induce "stimulated positron emission" from Bose condensate macroscopic electrons and/or other materials such as certain types of semiconductor materials. With this method we can generate Dirac Currents of positrons from constructively interfering quantum probability waves. Once these devices are achieved, we may soon have custom probability etalons that can selectively amplify any virtual probability and generate it as a physical reality to play with.

Enjoy your observations, and ...
See you with the dolphins in the Sirius B system! (When we develop the warp drive....)

Douglass A. White, August, 2003

* Fermions follow the Pauli exclusion principle that says no two particles in a system can occupy the same state.

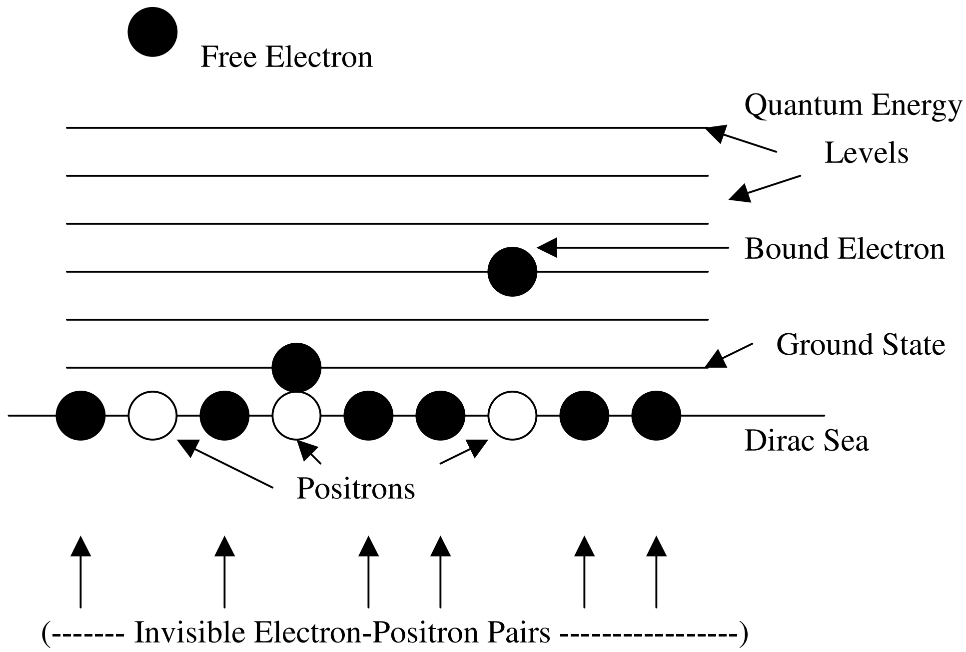
* In 1924 Satyendra Nath Bose sent a paper describing how particles with zero or positive integer spin would "condense" into a single state to Einstein for his opinion. Einstein translated it into German for publication and added the comment, "an important advance." This gave birth to the concept of bosons and BEC (Bose-Einstein Condensation.)

* Bosons do not follow the Pauli exclusion principle. "Any number of bosons -- or any number up to N, if the total number of bosons is fixed -- may occupy any given single-particle state." (Baierlein, Thermal Physics, 199-200)

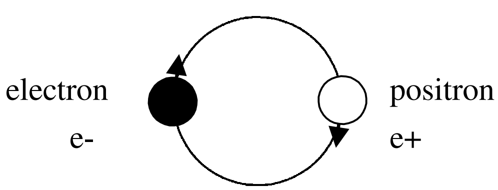
* "The bosons ' condense' into a specific single-particle state, the state ... of lowest energy. (Because they are particles of an ideal gas, the bosons do *not* cohere and form a droplet.)" (Baierlein, 203)

* A Bose condensate of electrons behaves as if it were a single electron in its ground state. The phase transition to this state occurs when the substance is cooled below its Bose-Einstein temperature. As examples of bosonic behavior in an sc, electric current in a superconducting loop will continue indefinitely (as for a single electron), and the magnetic flux will be quantized as for a single electron in its orbital.

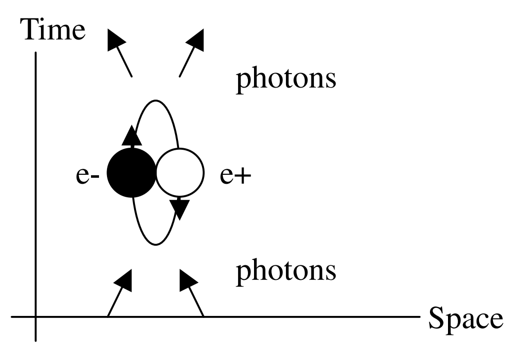
Diagrams Illustrating Principles of Dirac Current Positron Generator



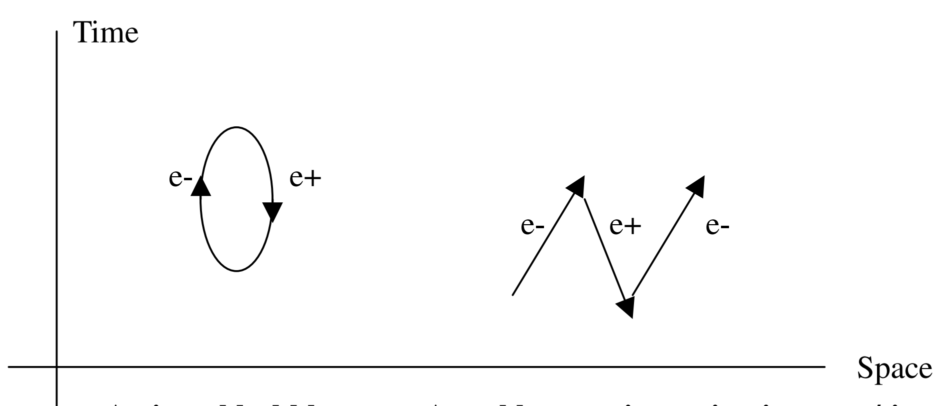
Each stable positron in the Dirac Sea is to be found in the core of a proton or neutron. All others annihilate whenever they meet an electron, and they tend to do so because they are electrically attracted.



Positronium

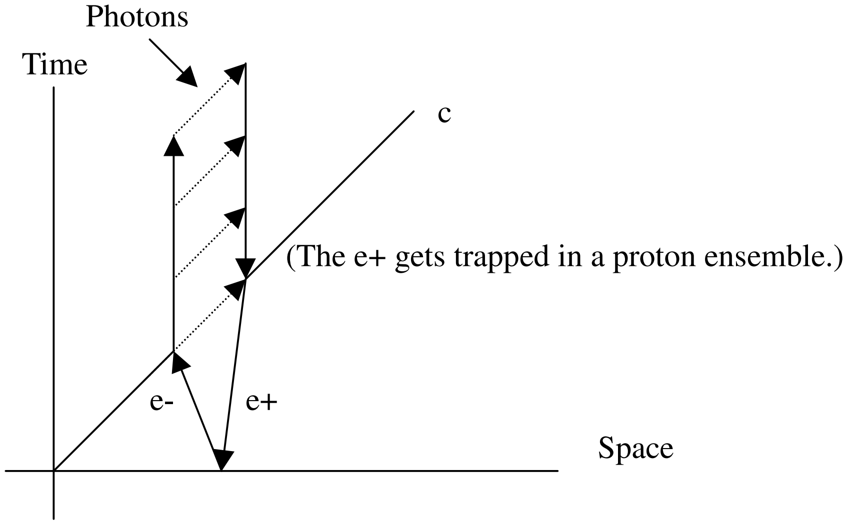


Virtual Pair Production-Annihilation

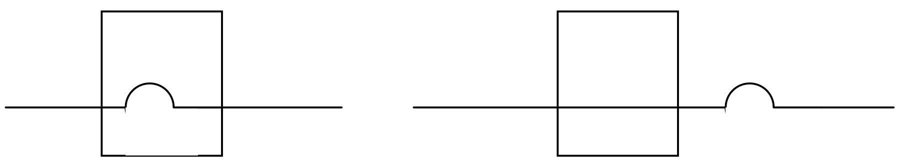


A virtual bubble **A real lepton zigzagging in space/time**

The virtual bubble occurs "silently", but slightly raises the vacuum zero point energy.



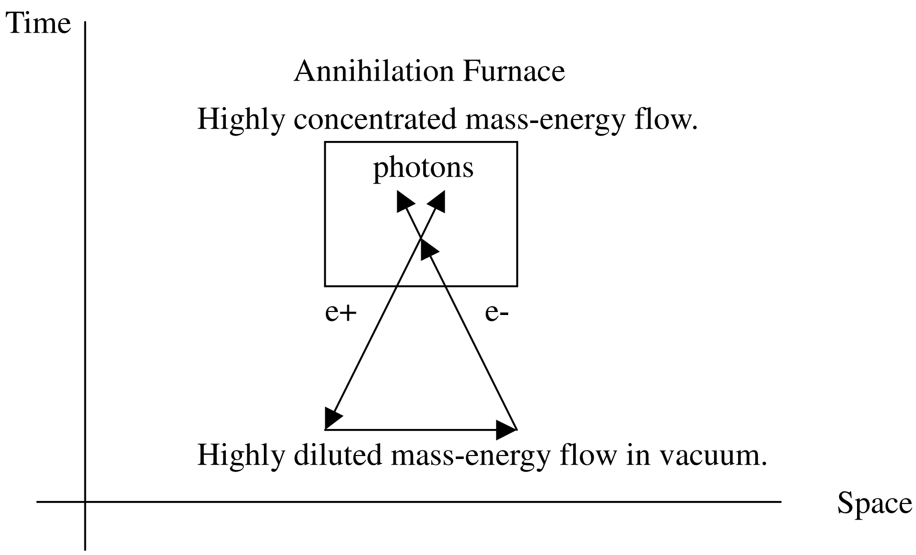
Highly simplified stable energy exchange loop of hydrogen.
(Each photon flowing through the loop has an antiphoton partner.)



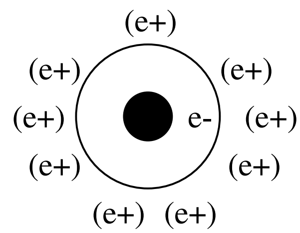
Electron Trapped In Cell   Electron Tunnels Out of Cell

Quantum Electron Traps

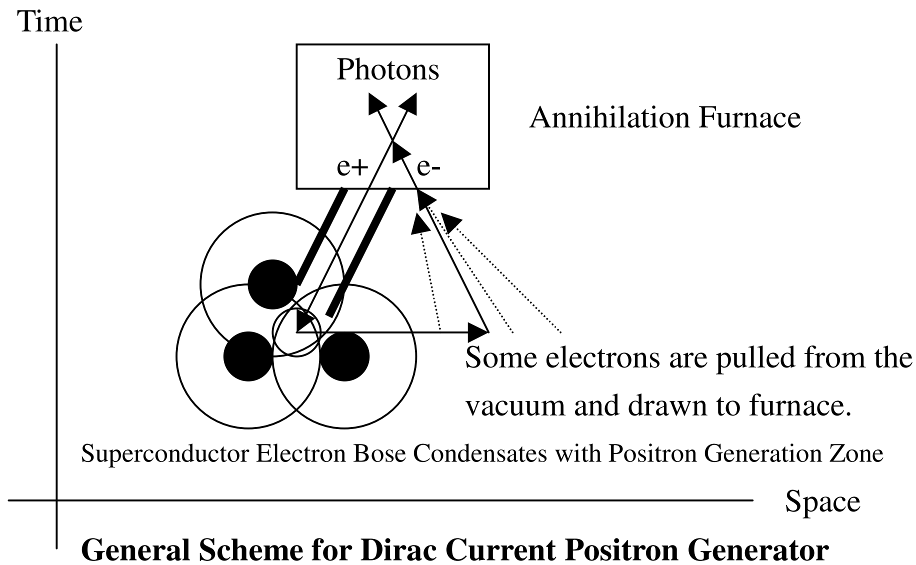
The electron probability wave can tunnel right through an impenetrable barrier.



General Feynman Diagram for Deliberate Nonlocal Pair Production
With Controlled Pair Annihilation



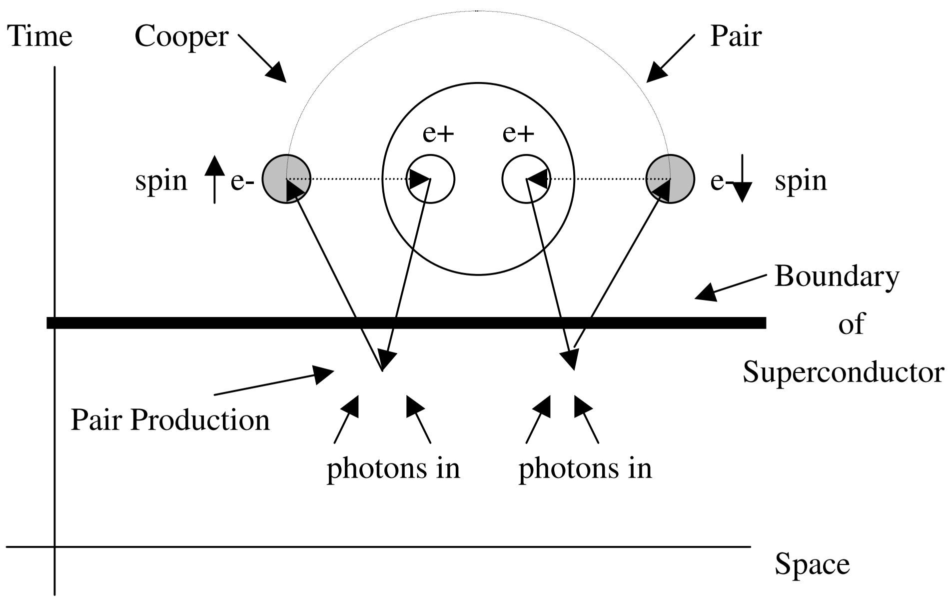
Cloud of virtual e+ surrounding a real e-.



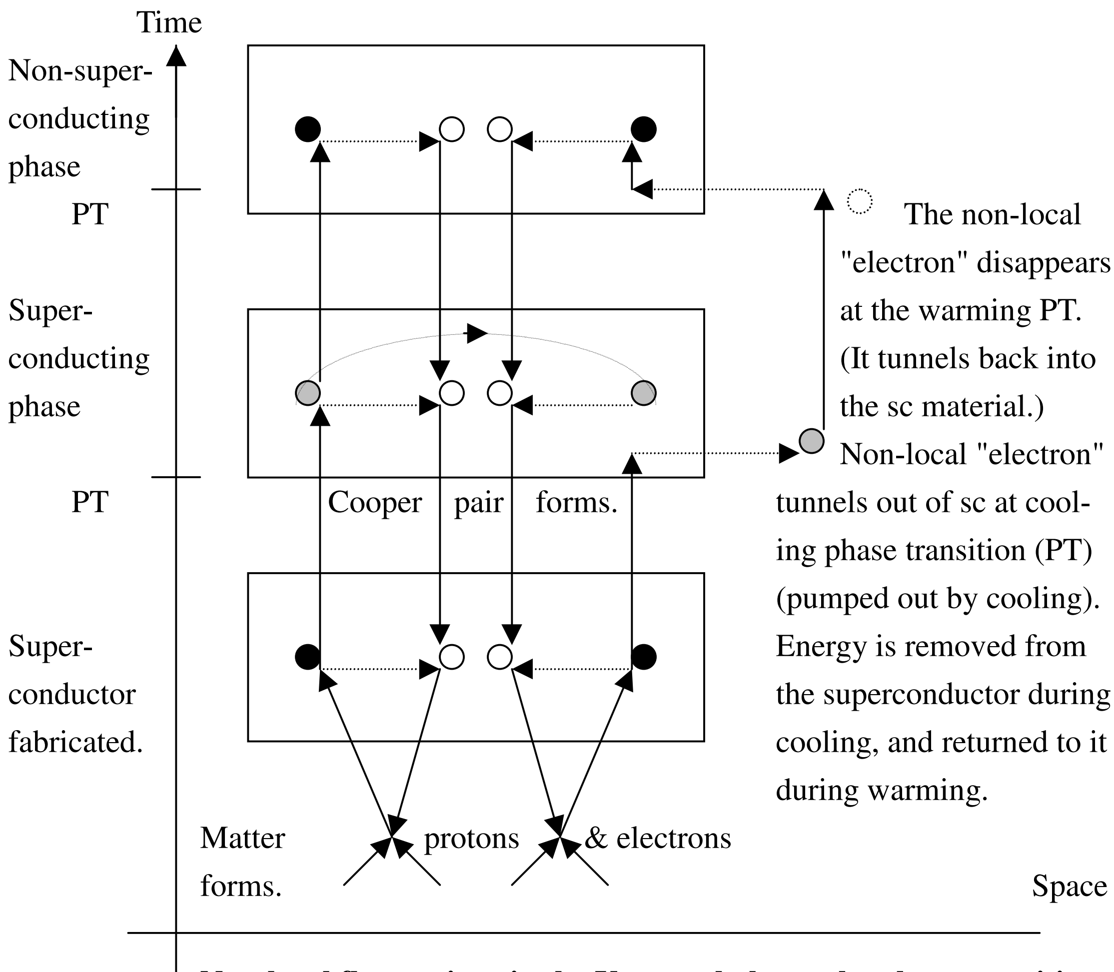
General Scheme for Dirac Current Positron Generator With Annihilation Furnace

* We use a high temperature superconductor to make a Bose condensate that converts many electrons into the equivalent of a single macroscopic electron.
* The vacuum compensates by (a) manifesting electrons to restore equilibrium or (b) by destroying some positrons within the nucleons of the superconductor. The latter process causes gradual decay of the superconductor as time passes.
* Like cold fronts, the Bose condensates are placed so that their amplified virtual positron standing wave probability fluxes overlap with constructive interference.
* This causes real positrons to condense like rain from the virtual positron clouds.
* The condensed positrons are channeled into the furnace via a magnetic tube and annihilate there with electrons. They come from the future, not go to the past.
* This rapid e+ e- annihilation in the furnace re-establishes the dearth of electrons in the locality, drawing more electrons up from the vacuum to restore equilibrium. Once the process is going we minimize the chance of proton decay and optimize for electron production.
* As long as we maintain the Bose condensates and keep the virtual positron probabilities overlapped, they continue to condense a stream of positrons.
* The positron generation process turns off when the Bose condensates are overheated or shifted out of constructive interference phase in the positron generation zone. The device works like a little controlled weather system.

Time-Reversed Version of the Positron Generation Loop
Proton Decay

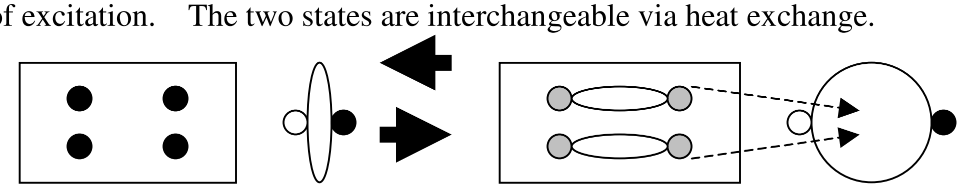


A Superconductor Passes Through Critical Temperature



Non-local fluctuations in the Vacuum balance the phase transitions (PTs) as a superconductor passes through its critical temperature.

* The time-reversed version of our pyramidal mass-energy loop occurs inside an exotic material with strong superconducting properties when it is cooled until it enters the phase transition at its critical temperature.
* As the Bose condensate forms, the gray circles represent conducting electrons whose probabilities are fading until they become virtual fermions. They form into Cooper pairs, bosonize, and melt into a whole crowd of bosonized electrons, losing their identities as distinct fermion electrons.
* Positrons are found in large numbers throughout the superconductor, two for each nucleon, and are equally balanced by the numbers of electrons if the material is not ionized, but the disappearance of fermion electrons due to the Bose condensation unbalances the ratio. The quanta of charges remain balanced in the semiconductor, but the cooling results in a loss of energy and a drop in entropy. The lower energy-entropy condition within the superconductor is balanced by an increase of energy-entropy outside the superconductor. We can envision this as pushing a bunch of virtual positron-electron pair production event bubbles boiling further out of the Dirac Sea. The quantum bubbles have a net zero charge, but do represent an increase in mass-energy and entropy in the vacuum outside the superconductor.
* When a group of electrons bosonizes inside the superconductor, a fully real positron probability wave from a proton core may tunnel backward in time to annihilate with its electron partner in the past, or forward if managed as in the previous diagram. Going backwards, it almost certainly gets to the freezing of the baryons (quark confinement) early in the history of the universe. The positrons can safely tunnel back in time this way because they stay insulated inside the proton during its history before it found itself inside a Bose condensating superconductor. Looking forward in time we see that a proton or neutron in the superconductor decays irreversibly reducing the superconductivity efficiency by disrupting the molecular structure.
* The diagram below shows in a very simplified manner the phase transition the superconductor goes through as it passes in and out of its superconducting state due to cooling and warming. The shift of conducting electrons into bosonic states causes electron energy to tunnel out of the material into random locations in the vacuum where it stimulates e+/e- pair production bubbles to higher levels of excitation. The two states are interchangeable via heat exchange.



Non-Superconducting Phase **Cooper-Paired Electrons in Superconductor**

Caveats

Although I believe the theory behind this proposal is sound, there are many engineering challenges to developing an actual embodiment of the technology.

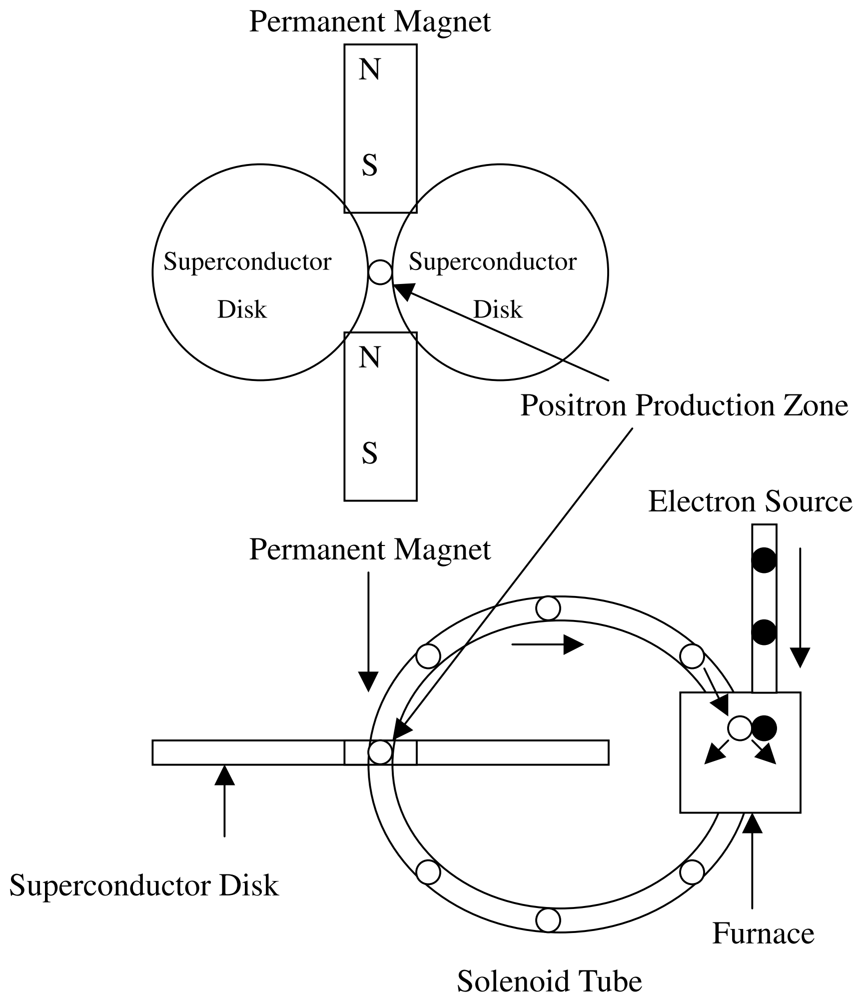
* For example, the closer you get to an electron, the higher the positron probability is. In fact this demonstrates that an electron can not be treated as a point particle. Otherwise the positron probability would converge at the point to form a real positron which would annihilate the electron. Thus each real electron has a certain "ground state" level of excitation that keeps it moving about in a certain space so that the positron probability that it attracts can not converge and annihilate it. If all vacuum excitation is removed, an electron drops into the Dirac Sea and disappears. This is what happens all the time with virtual pair production in the vacuum. Any positron we tease into reality will manifest as close as possible to its electron source (an sc) with an opposite charge that tends to draw it into the electron source. Thus the challenge is to suck the positron away before that happens. This requires setting up a repulsive force right next to the sc material. The geometry of how to position the sc material and the repulsive magnetic field is a major challenge. The basic approach is to get a pair of sc' s very close. Place strong permanent magnets on either side of the gap. The Meissner effect will focus the magnetic field into the gap. When a positron appears, it will tend to move toward one or the other sc. The magnetic field will force the positron to squirt out of the gap into a magnetic tube that guides it to the furnace.

* A second major challenge is that the sc material basically functions as a positron storage battery made by a complex process from very exotic materials. The sc will "run down" (gradually lose its superconducting ability) as we extract energy from it. It may be that by the time you figure the energy needed to gather the raw materials and fabricate and install the critical sc components, you equal or exceed the energy you can extract during the lifetime of the "battery". However, the device could still be useful as an energy storage and transport mechanism. The challenge is to find inexpensive ways to fabricate robust room temperature sc' s from abundant raw materials. An area to explore isnano-engineered biological materials.

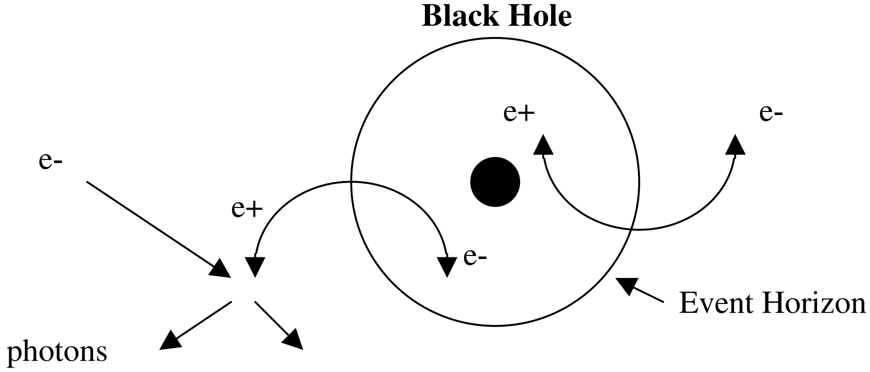
* Despite these difficult challenges, a proof-of-concept prototype would confirm the existence of low energy positron production and the stimulated proton decay.

Demonstration of either of these phenomena would be breakthroughs in fundamental physics that would spawn a revolution in technology.

Sketch of Details of Positron Generation Zone



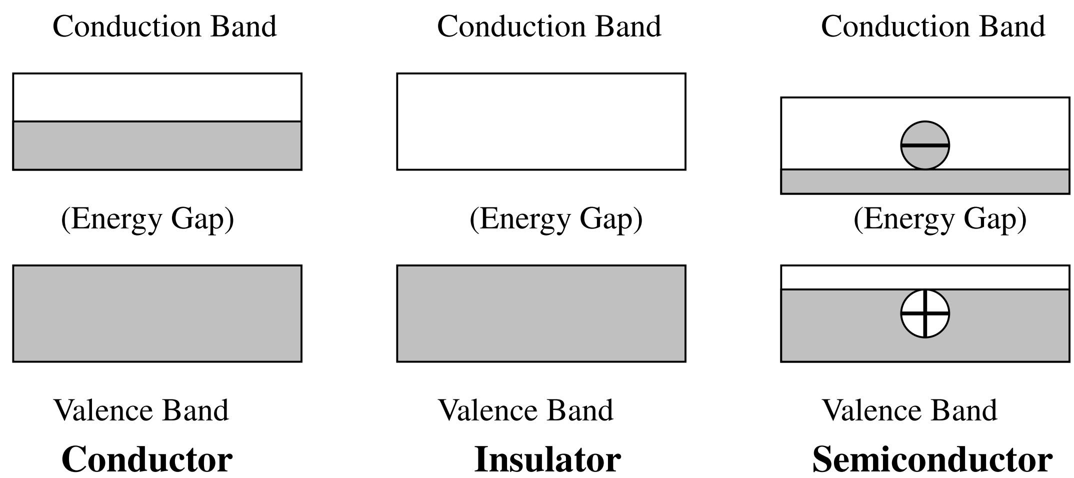
Black Hole



Spontaneous Positron Generation Due to Hawking Radiation Occurring at Event Horizon of a Black Hole

When virtual pair production occurs at the event horizon, a particle that happens to be inside the event horizon can' t get out. Particles just outside may escape from the hole.

Quasi-Positrons Generated in the Valence Band of a Semiconductor



(Diagram based on H. Benson, **University Physics**, ch. 42, p. 890)

Insulator: Valence band is filled and conducting band is empty. There is a large energy gap to push an electron into the conduction band.

Conductor: Valence band is filled and conducting band is partially occupied. Electrons in the conducting band can make transitions easily within the band.

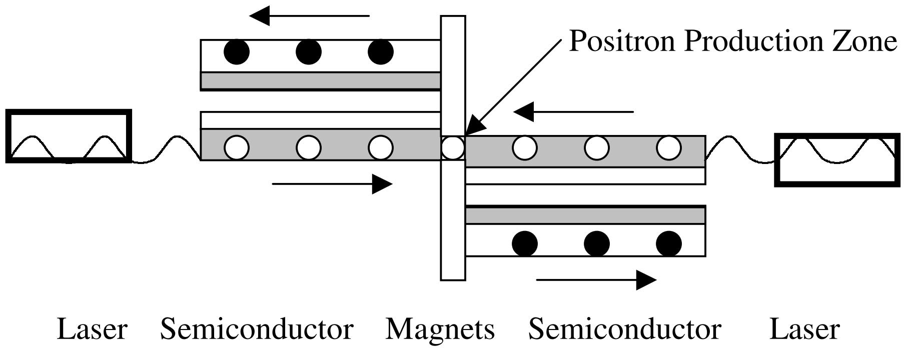
Semiconductor: Situation is similar to an insulator, but the energy gap between bands is smaller, permitting valence electrons to shift up into the conducting band under the proper stimulation. This leaves a "hole" in the valence band. The positively charged hole is a virtual positron that is almost "real".

When an electron orbital or band of an atom is full, those electrons are all effectively the ones in the lower orbitals. An n = 1 (1-s) orbital electron is held in its ground state because there already is an n = 0 subground state electron inside the nucleus. No two fermionic electrons can occupy the same state, so the electrons are forced to stack up in their orbitals, always tending toward the state of least excitation.
In the case of the semiconductor, we have a nice echo of the Dirac Sea at a higher energy level. Electrons in the valence band are like the invisible electrons inside a nucleon. They are paired with virtual positron partners. When a valence electron in a semiconductor is boosted up into the conduction band, the hole it leaves behind is like the positron left behind when a neutron decays into a proton. The difference is that one case involves relaxation and the other case involves excitation. It may be possible to tune a laser onto a semiconductor in its excited state and entice positron probability waves to tunnel out of the semiconductor's valence band into the positron generation zone of a superconductor positron junction configuration and thereby further enhance the productivity of positron generation. This would lower the semi-conductor's excitation, requiring re-excitation. We get a positron probability pump.

Concept Drawing

Semiconductor-Based Dirac Current Positron Generator

(Components not drawn to scale)



* This approach involves using the virtual positron current that occurs in a semiconductor when it is in its excited mode. A potential boosts electrons from the valence band across the semiconductor' s narrow band gap into the conducting band. This creates a possibility of electron current in the conducting band and "hole" current in the valence band. We tune conjugate lasers to tunnel "holes" into the positron generation zone, boosting the probability density until real positrons appear in the constructive interference zone. A magnetic apparatus shunts the positrons off into the annihilation furnace.

* When positron waves tunnel out of the valence band, conducting band electrons drop back down and the semiconductor de-excites, losing its conductivity. Therefore, to drive the device we must pump the lasers and pump the semiconductors.

* The general principles of operation of the semiconductor version are the same as for the superconducting device. The energy input to the semiconductor and the lasers pumps positrons from the vacuum into the valence band and then into the production zone and then to the furnace. Electrons can be sent from the conducting band to the furnace. The excitation of the semiconductor that separates electrons and holes is the same as the cooling of the superconductor that causes "fattening" of virtual quantum bubbles nearby. One system requires energy to cool the source, and the other requires energy to excite the source.