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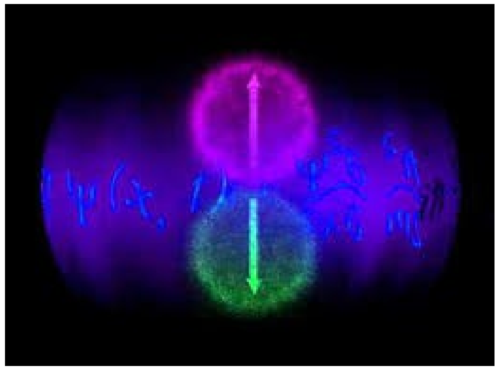
PROOF FROM THE MAINSTREAM
OF MY QUANTUM SPIN EQUATIONS



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In a paper published at ScienceMag.org on April 29, researchers at Trinity College, Cambridge, are announcing their findings of half-integer angular momentum on photons. They are selling it as confirmation of standard model predictions, but the sale comes with a series of fudges and pushes, as is usual with the mainstream. The findings are actually far easier to explain using my quantum spin equations and the theory that grounds them.

I usually lead with the mainstream theory, then follow with my own; but I have found that method to be counter-productive. Why? Because leading with mainstream theory just confuses all readers. All mainstream theory is a hash, so having to look at it in any way tends to turn your mind to a muddle. It tires out your rationality before you even have a chance to look at a rational theory. So I am going to reverse my usual progression and start with my own theory.

In my theory, I don't talk of “angular momentum” or of “quantum numbers” or of “eigenvalues”. In my theory we have real **spin** assigned to real particles. The photons or beams aren't given a set of unassigned numbers and then hidden behind a pile of jargon, they are a given real motions in real dimensions, and my diagrams and explanations allow us to track those motions visually any time we like.

I also don't talk about or use operators. My critics have used that against me, claiming it shows I don't know enough math. But the truth is, operators were imported into physics so that physicists could hide behind them. When you can make a logical and mechanical variable assignment, you don't need operators. The variables will do. You only need operators when you *can't* make a logical and mechanical variable assignment. An operator is basically a piece of *unassigned* math. It is free-floating and infinitely manipulable. This is why mainstream physicists love it, of course. It allows for infinite fudging and after-the-fact manipulation. If that has never occurred to you, just notice how the operators are being used in this problem and in this paper from Trinity College. It confirms my statement precisely.

If you aren't a previous reader of mine, you should start with two shortish papers: elecpro.html and super.html. Those will prepare you for this paper nicely. In the second, you will discover how spins are stacked on particles, using simple gyroscopic rules. In the first, you will learn to apply simple math to these stacked spins, to discover their relative sizes. This math works for all particles: photons, electron, mesons, and baryons (protons and neutrons). As a matter of radius, each spin is a doubling of the spin inside it, but we also have a turn to track as well. In other words, each spin is orthogonal to spins next to it, again obeying simple rules.

After reading those two papers, you will already be in a position to understand why the researchers at Trinity College are finding a halved number. You will also understand why the "speculations of theoretical physicists going back to the 1980s" concerning the possibility that angular momentum could "take fractions of expected numbers" were not so revolutionary after all. If they had known what they were doing, they should have predicted *only* fractions that were multiples of two. They should have known you would never find a fraction of 1/3 or 1/5, for example, and they should have known that was because each outer spin is twice the spin below it. It has to be to get beyond the gyroscopic influence of that inner spin.

But as it is, they can't do that. Why? Because in mainstream theory, nothing is real at the quantum level. They aren't tracking real spins on these photons. The photon not only has no real spin, it has no real radius or position. Because they weren't able to unwind superposition and the spin equations almost a century ago, they gave up and just began applying matrices to the events. That is, they began pushing math to fit the outcomes. This is what they do in any and all experiments now. They manufacture a set of numbers, call the numbers things like "angular momentum"—without assigning them to anything at all—and then push those numbers until they match the numbers coming out of the experiments. They then claim they are doing physics.

They aren't doing physics. They are doing some mad form of physical heuristics, but it isn't physics. It isn't even applied math, strictly, because the math isn't assigned to anything. For you to claim you are doing applied math, you must **apply** your numbers to real physical parameters of real particles. But they never get around to that.

For instance, angular momentum is really just a fancy word for spin. But because they don't use the word spin in most cases, this prevents people from asking "What is spinning?" They forbid you from asking that, because they cannot answer it. If you start applying angular momentum to real particles in the mainstream theories, the theories and math immediately start to melt down. You start seeing the big holes and the even bigger pushes.

We see that in this case, because the authors tell us in the **Abstract** that photons show this half-integer number only "in reduced dimensions". What does that mean? How do you reduce dimensions in an experiment? Are they claiming to have created a 2D experiment? Have they created some sort of dimensional vacuum? No, of course not. They are finding half-integer numbers in two dimensions only because their matrices are messed up. They have made some slippery dimensional assignments to their numbers, but those assignments have no basis in reality. The particles are showing halved spin radii not because they are in reduced dimensions, but because they are being stripped of outer spins. Something in the set-up is stripping what were formerly photons of 2x radius down to photons of x radius. But because they have no idea a photon can be spin-stripped in that way, remaining itself, they don't realize they have that to work with here. So, as usual, they are forced to come up with explanations that are far too complex.

That is confirmed in the final paragraph of the **Introduction**, where we are told

Here we show, in analogy to the theory of fractional spin particles (*14*), that an unexpected half-integer total angular momentum can arise for light. To do this, we note that the form $J_z = L_z + S_z$ for the total angular momentum of light follows from the rotational symmetry of Maxwell's equations (*17*, *18*). However, experiments involve beams of light propagating in a particular direction; thus, this full rotational symmetry is not present. The only potential symmetries, which determine the form of the angular momentum operators according to Noether's theorem, are rotations of the two-dimensional cross section of the beam around the propagation direction.

That makes no sense, because loss of such symmetry wouldn't imply a halving of numbers. In real physics, symmetries don't determine number values. Operators shouldn't attach to symmetries, they should attach to real motions of real particles. To see what I mean, notice they tell us their experiment "involves beams of light propagating in a particular direction". Really? How singular. I would have thought that any possible experiment could say the same. Do you know of any experiments where the same light was propagating in no direction, or all directions simultaneously? Do you think Maxwell wrote equations for light moving in no direction? Do you think this is the first time they have ever run an experiment where light was propagating in a particular direction? Why would they need some specialized experiment at Trinity College, with an apparatus creating a "screw-like" structure, to discover halved quantum numbers? They have had light moving in one direction for centuries, so why are they just now discovering such light is halved?

Plus, if the light is moving in a screw-like structure, it isn't 2D, and isn't moving in reduced dimensions. Light such as they are talking about in the **Introduction** would have to be moving in a line or plane. You can't draw a screw in a line or plane, last time I checked.

But we can see the fudges even before that, from the *first* paragraph of the **Introduction**, which has only six sentences but *eleven* footnotes! To solve this problem, they want you to believe you need high-dimensional entanglement, quantum dense coding, and efficient object identification. You don't, because those are just three horrible fudges. Entanglement doesn't even exist, just being a highly irrational theoretical explanation of something they couldn't explain rationally. See my paper on that subject for proof. Actually, Feynman tried to solve this problem for them decades ago—and came close to doing it—but it was one of the few places he was ignored. See my paper on his shrink-and-turn method for more on that. One you understand how light is showing a spin wave, you don't need particles communicating instantly with eachother across infinite space, or any other spooky forces.

Even more proof of this fudge is found at the start of paragraph three:

However, a general feature of two-dimensional systems is that angular momentum need not be quantized in the usual way. The orbital angular momentum of an electron orbiting in two dimensions around a magnetic flux need not be an integer, but can include an arbitrary fractional offset .

They want you to think that has something to do with the current problem, since the word "fraction" is found in both places, but it doesn't. They have the "orbital angular momentum" of an electron off by a fraction in those experiments because all their basic equations are wrong. You can tell that just by the use of the word "arbitrary". If they had a clue what was going on, they wouldn't need the word arbitrary, would they? I have shown the "offset" is not arbitrary: it can be calculated straight from the amount they are wrong in the basic equations. See my paper on the Rutherford equations, for instance. In short, the "arbitrary fractional offset" is a function of the fine structure constant, and their misunderstanding of it.

So that fraction has nothing to do with this fraction. If it did, both fractions would be ½. They aren't.

And we see the fudge again here:

These concepts have played an important role in understanding the quantum Hall effect, where the low-lying quasiparticles have fractional statistics that are related to their fractional charge (*16*).

Anywhere you see the word "quasiparticles" you will find nothing but fudge. If you want proof of that, see my paper on the Drude-Sommerfeld Model, where the smell of fudge is so strong you will need a chocolate filter. But you can also consult my paper on the Hall Effect, which is perhaps more to the point here. There I show the Hall Effect—quantum or otherwise—falls to a much simpler and more mechanical explanation, one that disproves quasiparticles once and for all.

The next section of the paper is called **Results**, but it is mislabeled. It doesn't contain results, it contains more pushed math. The first thing they do is extraordinary: they admit their two operators *S* and *L* (Spin and Orbital Angular Momentum) are not valid "because they do not preserve the transversality of the electromagnetic field". That should be clear indication their math and theory is wrong. Why not choose assignments for *S* and *L* that *do* preserve the transversality of the E/M field? Because their masters couldn't figure out how to do that. In other words, they couldn't unwind the real mechanics of the field or the real motions of the particles. The operators they have chosen only work when they are manipulated in tandem (and they don't work even then). I have solved that huge problem for them, but they don't seem to care. They have gone on as before.

Notice that they try to solve this with just those two operators. The Orbital Angular Momentum, or OAM, is what they came up with long ago to fill the gap between what they understood about light and what they did not. In short, because they weren't able to assign real spins to the photon, they came up with this second operator as a stop-gap. Since they didn't understand the real mechanics, they ditched the mechanics and mostly went virtual. At Wikipedia, they draw you some pictures, but the pictures don't make any sense. This is why they normally forbid you from drawing pictures or trying to visualize these things. Bohr and Heisenberg were right as far as that goes: they thought that if you couldn't draw sensible pictures, you shouldn't try to visualize these things at all. Better nothing than something bad. So they forbade visualizations or diagrams.

We know the OAM must be wrong, because if it were right it would have allowed them to solve the superposition conundrum in a sensible manner (also entanglement). Instead, superposition is solved to this day with various forms of magic, often with one photon taking both paths and interfering with itself. Because my spin assignments allowed me to easily explain detectors in sequence, square polarizers, and all the other mysteries, we know my theory must be right and theirs wrong. So the moment we see them trotting out this OAM as the operator *L*, we know they are going to lead us out in the bushes again.

If you don't believe me, I really suggest you study the Wikipedia page for OAM closely. I linked to it above. There is a lot of talk about "external" and "internal" OAMs, but they never tell you internal or external *to what*. The rest of the page is the same sort of embarrassing non-mechanical bushwa, and it is hard to believe anyone thought this was worth putting into print. Not only should the diagrams be permanently hidden and forbidden, as Bohr suggested, the entire verbal explanation should be as well. The entire theory should be locked in a safe somewhere, deep deep underground. Surely no one believes this resembles science in any way?

If you still don't see what I mean, notice the first sentence, which is

The orbital angular momentum of light (OAM) is the component of angular momentum of a light beam.

The OAM is not assigned to a photon, is it? It is assigned to some nebulous thing they are calling a beam. Isn't a beam just a collection of photons? If so, shouldn't you assign your operators to the actual particles, instead of the collection? If you don't, you are just begging the question of how your actual particles create the OAM. But of course they dodge that with all possible rigor. Also, if you assign your operators to the beam, then *of course* you aren't going to be able to explain experiments with one photon. Your photon has no variables or operators, so how could it be anything but mysterious?

In my theory, all the spins belong to the photon. I never *ever* talk about a beam, at least not when I am doing foundational theory. It was clear to me from the start that if you have a field particle like the photon, you have to assign your variables (or operators) to it. Assigning operators to a field is just perverse.

You see the fudge again after equation 2, where they say

the irrelevant radial dependence of the eigenmode is omitted.

They create these fake equations and then just jettison anything that later comes up that gets in their way. But the radial dependence of the eigenmode isn't irrelevant, or shouldn't be according to their own postulates—especially when they are dumping half their symmetry to get their halved numbers.

As you see, they are forced into these multiple embarrassing fudges because they don't have the right spin mechanics. They don't understand how these spins are stacking, or how the photons are creating waves, so they have to push the math after the fact.

Finally, we get to the meat of the experiment in the late section **Experimental Details**. This is the way of Modern physics: lead with a lot of misdirection and cloaking math and then report the real results—if at all—as tack-ons or details. It is in this section where we discover how the light was spin-stripped. The light was first polarized and then collimated. It was then split, and the two beams were rotated 180 relative to one another. Each polarization was rotated by 90. This last was achieved by using a pair of half-wave plates. The beam rotation was achieved with "a special prism that did not lead to an angle-dependent effect on the polarization". That is, a quarter-wave plate. Finally, the two beams were brought back together and sent to the analyzer.

Now, it is clear that these multiple manipulations might spin-strip our photons in one of several ways. First, they might actually strip the outer spin from each and every photon. Since that would require input and output energy changes, I doubt it is happening here. It *can* happen, but I don't see why it would happen here. This sort of thing would happen when the light passed through a high energy field, for instance, and every photon would be stripped in the same way and the same amount. Second, it might hide one of the photon's stacked spins by putting it orthogonal to the final machine that reads it. The machine would then be forced to read a secondary wave instead of the primary wave. Third, it might array the light against itself, causing opposite photons to spin-strip one another. But that would require photons moving parallel to jostle side to side, and, again, I don't think that is happening here. It would only happen with very non-coherent light. Since we started with lasers, there is no reason for the photons to jostle like that. Imprecision in instruments could also cause it, but you would need large instruments or long paths to the analyzer. Fourth, it might create a final beam composed of half photons and half antiphotons, moving in parallel. Since the analyzer reads collections of photons, not individual photons, it would read zero for total spin. To get a reading, you would have to set the analyzer to read the secondary spin instead of the primary. In which case you would get a halved number. I think you can see that is what is probably happening.

We started with a laser, which meant the light was initially coherent. But in splitting and rotating the beams, one arm of the light was flipped relative to the other. When the light was brought back together, half the photons were spinning opposite to the other half. In effect, one arm was now composed of antiphotons, relative to the other arm. Over any given width of field, each antiphoton *negates* the spin of a photon, making the field read flat. The analyzer then has to be set to read the underlying spins of the photons, which have a radius half the hidden spin. Which means the quantum number they are reading is a function of radius.

Notice I said *negates*. Nothing is superimposed there; nor is anything stripped. All outer spins are unaffected. But because the analyzer is not reading individual photons, it must read field sums. A photon and an antiphoton moving parallel don't destroy one another, and they don't even jostle. In some fields they will be attracted to one another, but in other fields they won't. In weak fields and over short distances, they won't interact at all. In the current problem, they are simply summing. The combined spins read flat as a matter of angular momentum, but the total energy of the beam isn't effected.

You can see what I mean by looking at their own explanations:

These new forms of total angular momentum differ from the standard one, but nonetheless have the physical properties we expect. The established method for measuring an optical angular momentum, be it *L*, *S*, or *J*1 = *L* + *S*, involves rotating the beams traversing a Mach-Zehnder interferometer (*6*). This measurement exploits the fact that eigenstates pick up a phase factor *eij*ϕ when rotated, where *j* is the quantum number of the measured angular momentum and ϕ is the rotation angle.

If an eigenstate can pick up a phase factor when rotated, it can also lose one. So to put it in their own language, if you rotate the right eigenstate in the right direction, you can lose half the integer value of that eigenstate. But if you want to talk about real motions instead of eigenstates, you would say that rotating the photon in the right way relative to your final machine will hide its main spin from the machine, forcing the machine to read the spin below that. That will also give you the halved number. As I just showed, that "hiding" can be done in several ways, but here we would expect it to be done by a simple field mixing.

In the section called **Details of the Input Beams**, the authors do a flyby of the right answer, but still manage to make a hash of it. There they say that the final beam is a superposition of

eigenstates of the mixed angular momentum $J_{1/2}$ with eigenvalues ±1/2, as indicated.

Or more simply,

Thus, the generated beam was a superposition of $|j = \pm 1/2\rangle$

As you see, that sort of moves in the direction of the right answer. But the beam can't be a superposition of values, because in that case the analyzer would have to read either both or zero. A machine can't read an absolute value. If they are assigning $J_{1/2}$ to an angular momentum, then that momentum has to represent some real energy of the photon or wave. And if that is so, they have to explain why a superimposed wave of momentum ±1/2 doesn't sum to zero. Remember, in quantum math, that doesn't stand for plus *or* minus ½. It stands for plus *and* minus ½. Angular momenta of plus and minus ½ should sum to zero energy, unless the analyzer has some way of reading them separately. Which should mean a superimposed wave of that sort should lose total energy. Or, the machine would read it as both plus ½ and minus ½. Since machines can't do that, we would expect the machine to read zero.

I will be told this is one of the mysteries of superposition, but it is a manufactured and unnecessary mystery. I just showed you the simpler answer, and it doesn't include superposition.

We see the hedging again here:

We argue that the operator $J_{1/2}$ is an angular momentum because it is a generator of rotations and because it can be measured by interferometric techniques analogous to those previously used.

That's a curious way to put it, don't you think? "We argue that the operator $J_{1/2}$ is an angular momentum"? Shouldn't they know by now which operator is what? In creating any theory or prediction or math, shouldn't you be required to assign your operators *before* any experiments? Assigning operators after the fact is a clear fudge. But that is what I warned you about operators above. An operator is a strange beast of just that sort: it can exist unassigned for decades, then be assigned at the end of an experiment. And in an array of experiments, it can be assigned in a multitude of ways, with no requirement that these assignments be theoretically consistent.

Clearly, they are cobbling their math to fit the experiment after the fact. But if they are doing that, how can they say the new halved number doesn't fit old expectations, or that it is indication of something new? If they didn't know beforehand what operator went with what motion, they couldn't have had *any* expectations, because they didn't have any clue what was going on.

I have just shown you that operator $J_{1/2}$ must be a function of the real photon radius. Since in my mechanics, all angular momenta are functions of the radius, that does not necessarily falsify what they have guessed, but it certainly clarifies it.

I say the angular momentum has to apply to the photon, not to the beam, because a beam *can't have angular momentum*. A light beam is just a collection of moving photons, which makes it a field of photons. But a field cannot have angular momentum. Only *the particles in the field* can have angular momentum, which then may be summed. As usual, it is hard to believe I have to be here saying this. It should be taught in the first week of any physics course, or be innately understood by any physicists; but instead it has taken on the status of a zen koan.

I concluding, let me hit it one more time for good measure. Go back to where I say there are four possibilities for what is going on here. If I had picked 3) instead of 4) as my explanation, that would have created a real spin stripping of the outer spins of all photons. In that case, I would have to explain why my light didn't lose energy or change color, wouldn't I? It is exactly to avoid questions like that the mainstream hides behind eigenvalues, dense math, and irrational theories. If they get you confused enough, they can hide behind superposition here, and no one thinks to ask them about energies, colors, or anything real. But as I showed you, the right answer has to do with sums or averages of groups of photons, not superposition. Superposition exists, but I have shown it exists within each photon, and is an expression of stacked spins. That isn't what is being measured here. No analyzer can analyze either stacked spins or superimposed spins, real or intrinsic. It can only measure some field result. If it is measuring angular momentum, it can only measure one at a time. It can't measure absolute values or symmetries or plus/minus values.

Yes, you can shunt part of the output beam into one machine and part into another, but each machine can only detect a given parameter. The same machine can't detect superimposed values.

As final proof of that, notice that the authors avoid telling you much of anything about the analyzer, or how what it read was used to get the number ± ½. We are only told the beam goes to a photodiode, where

The path lengths are tuned such that each component interferes constructively at one output port and destructively at the other. . . the angular momentum current is thus related to the rates of photon arrivals P_1, P_2 at the two outputs. . . .

To start with, notice that the angular momentum has to be *real* for that to mean anything. Intrinsic or virtual qualities cannot interfere or interact in any way. But even given that, the paragraph makes no sense. How could interference or the angular momentum current (whatever that is) be related to the rate of photon arrivals? They appear to be assuming that wave crests are caused by higher photon densities, which is naïve in the extreme. These are not water waves. In light phenomena, wave troughs aren't caused by lack of photons, they are caused by photon spins at that point not being in line with the linear motion. In other words, when the linear motion is parallel to the spin motion, you get a crest; when it is anti-parallel, you get a trough. Every photon can create a wave like that, and field waves are created by photons that are coherent. In other words, by groups of photons that are crest-matched. Therefore, all the math and theory at this point in the article must also be a hash. I don't doubt they are finding something halved here, since I have shown you why their apparatus would find that; but this math is a push so heinous not even I can unwind it.

Someone should also ask them why there would be fewer photons at certain points in a beam. What is the mechanics of exclusion? In other words, if photons are clumping in a beam, there should be a reason. They have no answer to this question. My answer is, "The photons *aren't* clumping". There are no photon density variations in the beam of that sort. There are **energy** variations, yes, but those are caused by spin directions, not densities.

It looks like their raw data was voltages in two ports, so what they were measuring was energies, not photon densities. Wave troughs have lower energies not because they contain fewer photons, but because the photons that create the troughs have a spin energy pointing backward to their linear energy. The total energy of any photon as measured by a given device at a given point on its path is its linear energy plus its spin energy. So a lower voltage *could* indicate a lower photon density, but in this case it is indicating more trough photons in one port than the other. Of course you can then calculate a spin speed from that, but you would calculate it straight from the energy differential and the path length differential.

To see one last indication of the fudge in mainstream physics, and in this experiment, we can look at the photodiode used. A photodiode turns light energy into current. Since the voltage of this current is the raw data they used to fill their equations, they should understand how a photodiode works, right? Nope. If you check mainstream theory for the photodiode, you get this

A photodiode is a p–n junction or PIN structure. When a photon of sufficient energy strikes the diode, it creates an electron-hole pair. This mechanism is also known as the inner photoelectric effect.

That old mess. See my paper on the p-n junction, as well as the paper linked above on the Drude-Sommerfeld Model, which also uses these ridiculous electron holes. In short, they have no idea how a photodiode works, only that it does. A photodiode works because light photons work just like charge. Charge and light are the same thing. So hitting a photodiode with light is just like hitting it with charge. Light hitting anything will charge it, but of course a photodiode is created to maximize the efficiency of charging, by setting up easy entry paths into and through the substance. This is done by aligning molecules in the right way, as in any diode or other conductor. The only other thing worth mentioning here is that light works best as charge when it is nearest the infrared. Light of other energies may have to be stepped up or down to act most like charge. This is because in order to create current, the photons have to be channeled through the nucleus, and the nucleus is set up to channel best at the infrared. Why? Simply because that is both the average and the peak of real photon energies. The nucleus is an engine tuned to the given field.

I will answer one last question on the way out, as a nod to clarification. I will asked, “If the voltage of the beam isn't effected by this summing to zero you have shown us, how can it be measured using voltage?” Well, the researchers at Trinity ran across that problem themselves, as you see from their paper. They had to split the final beam, letting half of it take a shorter path than the other half. This was explicitly so they could find that specific point in the wave where the spins were canceling, or summing to zero. And, they *did* find a voltage drop at that specific point. What I meant above is that turning half our photons into antiphotons wouldn't effect the voltage of the beam as a whole. But the researchers showed that you can rig your analyzer to measure a given point in the wave, not the wave as a whole. And at that point you will find a drop in voltage. Remember, they assigned that drop to fewer photons, but I showed you that isn't what is happening.

Anyway, this just proves it wasn't superposition causing anything here. They admit they used constructive and destructive *interference* to create these different path lengths. Interference, not superposition. Well, the spin cancellation or summing to zero I am pointing to with photons and antiphotons is a type of interference, not superposition. In my theory, all interference is a summing of real spins on real photons. So another way to look at this experiment is that they were creating antiphotons of just the right sort, which caused an extra level of interference. Then, using the right equations, that interference made it look like one of their quantum numbers was being halved. Strictly, it wasn't, since their quantum numbers are all ghosts. All that was really happening is that the photodiode was being forced to deal with photons arriving with outer spins canceling, so that the energy transferred at the boundary was a function of the spin beneath that.

The truth is, you can create the same effect without antiphotons or split beams. You just start with very coherent light, where all the photons are spinning the same way. Then you set the photodiode at the point in the wave where all photon spins are sideways to the machine. You then magnetize the photodiode opposite to that spin direction. Either that, or create an electric field moving opposite to that spin, right at the boundary. The spin will be canceled, and the photon will impart only the energy of its linear motion and the energy if its inner spin. So not only will you have a drop in voltage, you will have an apparent loss of angular momentum.