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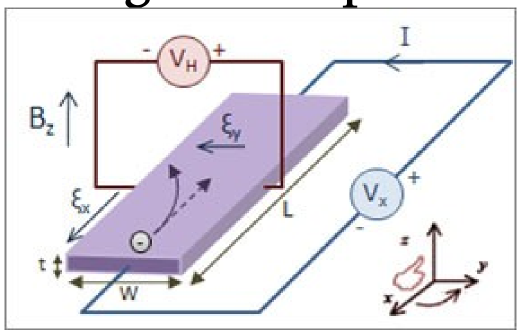
The Hall Effect

a charge field explanation



by Miles Mathis

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The Hall Effect was discovered in 1879 by Edwin Hall, and consists of a small secondary E field orthogonal to the original E field, once a magnetic field is applied. It is also orthogonal to the applied B field. We are told the cause of this new field is that electrons in the current are turned by the B field, collecting on the left face of the substance (see diagram above). This creates charge separation from left to right, which then pulls the electrons back to the right.

That seems pretty straightforward, so most people have accepted it. It doesn't (at first glance) rely on any of the standard fudges, so few in the mainstream have thought to question it. In other words, it seems to stick to poolball mechanics, without hitting us with any of the common dodges into virtual particles, symmetry breaking, renormalization, and so on. Many who don't look very closely may think the solution has something to do with entropy, since electrons clumping on the left might seem to dissipate to the right without much more being said. However, since the mainstream solution uses the electron as the field particle, we should know this explanation isn't right without further study. We now know that current isn't a current of electrons, that the E field isn't created by electron flows, etc. Electron flows are a *result* of the E field, not the cause of it. Electron motions can't *cause* electron motions.

But there is an even more obvious problem, and the mainstream saw it from the beginning. In classical theory, electrons can't be moving right to left to cause the curve to the left, and also be moving left to right to cause the reverse potential and the second E field. In other words, the potential can't be opposing itself. If the electron motions are the cause of the potentials, the potentials can't be causing the electrons to move in opposite directions at the same time.

And so, the mainstream *has* made use of one of the standard fudges: it brings in a virtual or quasi particle, in this case an **electron hole**. As they put it at Wikipedia:

In the classical view, there are only electrons moving in the same average direction both in the case of electron or hole conductivity. This cannot explain the opposite sign of the Hall effect observed. The difference is that electrons in the upper bound of the valence band have opposite group velocity and wave vector direction when moving, which can be effectively treated as if positively charged particles (holes) moved in the opposite direction to that of the electrons.

There is your awful fudge for the day. Electrons have an "opposite group velocity." In other words, they are moving against their own potentials. They are moving like protons.

But even without that towering contradiction of the field and particle definitions, this explanation still doesn't work. Why? Because it ignores its own fields in perhaps an even more fundamental way. Remember, the current will create a magnetic field *even before we apply one*. So we don't have one magnetic field here, we have two. Their little right-hand rule diagram in the lower right corner (see diagram above) should have reminded you of that, but it probably didn't. As diagrammed, this material is being fed current by a wire, so that if the initial E field is coming toward you, the initial B field will be counterclockwise. If we then apply a second B field, we then have two B fields that have to be integrated or otherwise tracked.

The B field is diagrammed with a vector up to make the Lorentz force work out. But even with this extra B field, it looks impossible to apply two opposing forces to the same electrons using mainstream field theory. Which is why they should have known the electron is not the field particle here. As soon as they had to start making the electrons act like protons or electron holes, they should have known they had the wrong theory. If you have to break your theory in such awful ways, the theory cannot possibly be right.

So let us take our new B field and use it to explain all this with charge. That's right, we will explain it with real charge photons instead of electrons and electron holes. We start with just the initial E field. As I have shown in many previous papers, this field is actually a stream of charge photons. Yes, this stream can drive free ions if they are available, but the ions are just boats on the stream. They are a further effect of conduction, not the cause of it. Conduction is a charge effect, and it is caused by the linear motion of photons. Sub-E fields can be created by photons even with no ions present, and I have shown in previous papers how this explains many mysteries in the Solar System and galaxy.

Since these charge photons have real spin, we find a simple mechanical cause of the initial magnetic field as well. The summed spin of the photons will create a sub-magnetic field, one that will drive ions thereby creating a magnetic field. These photons *can* create the magnetic field directly, but in most cases here on Earth, they don't. The photons recycle through the nuclei in the substance, and the spinning nuclei create the magnetic field. As we have seen in my nuclear paper, charge that is recycled from pole to pole in the nucleus creates conduction and the electric field, and charge that is recycled pole to equator creates the magnetic field. This is the simple explanation of why we see the two fields not only orthogonal, but *spinning* orthogonal. In other words, 90 degrees *and turning*.

This gives us our first E field and our first B field in our substance. Now we apply a second B field, but this field is said to create a potential for motion right to left in our substance (for the electrons). To do that, we have to apply **a second field of photons** to the substance. The only way to apply either an E field or a B field is by sending in photons, since the photons carry both fields. Since the electrons are moving left in response to this field, we can look at the E field of our new photon field, instead of the B field. Our first assumption should be that our new E field associated with this new photon field is moving in from the right. That would push the electrons left by linear motion, so it is the first thing to look at. But can a B field up go with an E field moving left? Maybe, maybe not. Since we are looking at this in a new way, it requires more analysis.

The thing to notice so far is that we have two separate fields here. Every electric field creates a magnetic field, and the reverse, but that isn't what we are seeing here. We have *two separate E/M fields*, with two separate causes. Mainstream theory usually doesn't bother to stress this, but it is very important. It is important in all problems that use a Lorentz force, because it is true of all Lorentz forces. As we see at Wikipedia, Lorentz forces

describe the magnetic force on a current-carrying wire (sometimes called *Laplace force*), the electromotive force in a wire loop moving through a magnetic field (an aspect of Faraday's law of induction). . . .

Take note that this force on a current-carrying wire and in a wire loop is not caused by its own magnetic field, but by an external and independent magnetic field. We have *two* E/M fields meeting.

We can see this going all the way back to Faraday's iron ring apparatus, in which conducting wires were wrapped around opposing sides of the ring. Again, we see two separate fields, since the iron has its own field before the current is applied, and the wire will have a magnetic field with or without the iron ring. This was the beginning of what has been called electromagnetic inductance, and it was of course also the beginning of Maxwell's equations.

So let's return to the problem at hand. Let us try to explain a B field up as a left-moving sub-E field instead and see if we can make that work. Why would photons moving left create a linear B field up, or the appearance of one? To answer that, we should try to answer an even more fundamental question: how can you create a **linear** magnetic field to start with? If photons are moving in a straight line in the direction of E, how can the magnetic field created by those photons be anything but curved? I have shown that the magnetic field is created by spinning photons, so a linear magnetic field is hard to imagine or comprehend. Well, if we are talking about the field right around a photon or nucleus, the magnetic field can't be anything but curved. But if we are talking about a summed field—as in an extended substance—we have to look closer at the mechanics.

Let's start with charge being conducted pole to pole through a given nucleus [see my paper on Period 4 for more on this]. If the nuclei align to this charge, then we have a linear path through the substance. This will create an E field, and—given ions—it will also create current. The alignment of the nuclei will create long lines of charge, which is the cause of all current. Since these nuclei are spinning, we also have a magnetic field. But the channeled charge of our initial E field won't pass through this magnetic field, since the magnetic field is being emitted at the equator of each nucleus. So the channeled charge isn't moving through that field. Since it is channeled, it is moving pole to pole *inside* the nucleus. It is not passing between nuclei and coming into contact with the equatorial magnetic field at all. This is why current isn't turned by its own magnetic field.

But say we introduce a second field of charge coming from the right side of the substance and therefore the right side of each nucleus. This charge can't also be conducted, since the nuclei are facing the wrong way. They can't align to both fields simultaneously. So this second field of charge *may* encounter the magnetic field of the first charge field. It may encounter the equatorial charge of the nuclei. Since this field is circular, you would think the second field could be turned any direction, depending on the point of hit. But since the second charge field is coming from the right, it must hit the right side of the equatorial stream. If we match the diagram above and let the first charge stream go into the page, then the south pole of each nucleus will be pointing right at us. This will make the carousel spin (equatorial spin) on the nucleus counterclockwise as seen by us. And that will mean the vector on the right side of the nucleus will be up.

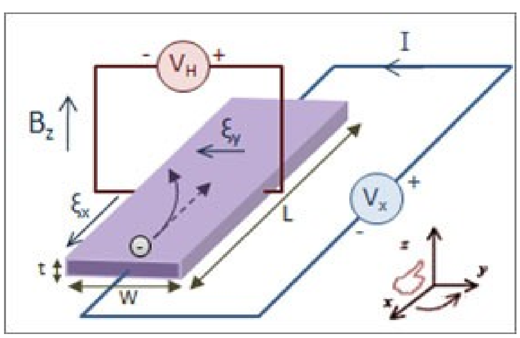
And so, we have shown the genesis of two new vectors. Our second charge field interacting with the first charge field can cause either a deflection up or a push left. If the photons miss the nucleus, they will continue on to the left. If they hit it, they will go mainly up. That will create what looks like a linear B field.

As you see, neither vector is really magnetic. Since both are caused by a linear motion of real photons, they are a sub-*electric* effect. The spins on the photons aren't the cause of much of anything here [except the initial spin on the nucleus], so we have no real sub-magnetic effect. No sub-magnetic effect; no magnetic effect. Which means the linear B field here isn't really a magnetic field.

The only way it can be thought of as a magnetic field is due to the fact that the spin of the nucleus *caused* the up deflection. Since the motion was caused by spin, it can be thought of as magnetic in that way. But since the up B-vector is immediately caused by the linear motion of deflected photons, I propose it would be most correct to call this a sub-electrical effect. The important thing is not the tag, it is that you understand the mechanics. Call it whatever you like, but just understand the motions of the real particles here.

You will say, “Well, if we have two new vectors, why don't we seeing anything moving up? Why is the secondary ion motion in this problem right to left or left to right?” Simply because most photons coming in from the right *don't* hit the nuclear equator or its magnetic field. Due to statistics, it will be far more likely for the second charge field to take open paths between nuclei. There is much more *free space* near the poles of the nuclei and between the poles of adjacent nuclei, so charge will travel there more easily. This second charge field isn't channeled through the nucleus, it is channeled between the nuclei. Only a very small portion of it would be expected to be diverted up.

OK, so you see once again we are making quick progress. I want to pause and point out an important thing we have learned—something you may not have noticed. When we apply the second B field, it must align itself to the existing B field. This is because it is being applied to a field that already has both nuclear and charge structure. Our first E field aligned all the atoms or molecules, and unless our second B field is much stronger, it won't be able to break that alignment. It must co-exist with it in some way. As you have seen, our second B field is created by our second charge field interacting with our first B field. So all our fields are interdependent.



With all that on the table, let us return to the Hall voltage. How is that created? Again, it is a reverse potential, pointing back to the right as far as electrons are concerned. [In the diagram above, it is drawn with a vector left, but that is for positive charge. The Hall potential for electrons is a vector to the right.] This just means that once our ions have been pushed left by the second charge field moving left, they will want to return to the middle for some reason. Why would they do that? What is the cause? The cause is something no one has thought to look at before, and they couldn't look at it because they weren't solving this with the charge field. The cause is a boundary condition on the left side of the substance, created by our second charge stream leaving the substance and meeting the ambient charge field. Not only do we have a lot of electrons piled up over there, but we also have our second charge field leaving the substance at the same place. Remember, charge doesn't just move into substance, it moves *through* substance. It is being recycled, and leaves as quickly as it came. Although a lot of electrons are trapped or diverted by that boundary, fewer photons are.

In fact, it might be useful to ask why the electrons pile up over there, rather than being driven right out of the substance. If we understand why the electrons are doing what they are doing, we will better understand why the photons are doing what they are doing. We know the electrons are following two paths: one into the page caused by the first current, and one left caused by the second field. But we also know which one is stronger: the first one, since if the second were stronger the substance would align to it. Therefore, the electrons must be hitting the left boundary at less than a 45 degree angle. In other words, they are moving more into the page than to the left. This shallow angle prevents them from leaving the substance in greater numbers.

But again, why? Shouldn't the ambient charge field be less dense than the internal charge field of the substance, making it easiest for the electrons to simply escape? It would seem so, but we have to look at something everyone is missing. To have this second B field, those running the experiment have to *create* it, and they have to create it from the existing charge field in and around the substance. Those photons have to come from somewhere, and they are coming from the fields that were already there. To create a field in a lab, you don't import charge photons from outside the lab, do you? No, you create it from the fields already present. You just rearrange the photon densities in the existing field to make them move the way you want them to. Well, if you want charge to move from right to left here, obviously you have to create a potential for that motion. You remove charge from the left and stack it on the right. It will then want to move back to the left. That is what we are seeing.

Or, to be more precise, you remove charge *photons* from the left and funnel them in from the right. This creates a charge photon deficit on the left side. But since your substance will initially have a higher density of these charge photons than the ambient field will, most of the photons you are removing from the left side will come *from the substance*, not from outside it. In creating the second B field, **you have created a charge photon deficit in the left side of your substance**. The stronger your created field, the greater the deficit.

In this way, we find a weakened charge field on the left side of our substance. In fact, it will be so weak that it will be trumped by the ambient charge field coming into the boundary from the left. The incoming charge will actually be stronger than the outgoing charge at the boundary, and this is what keeps the electrons from moving across the boundary. It not only prevents them from crossing the boundary and escaping the substance, it actually pushes them back to the middle.

To look at it another way, that deficit not only creates a field low felt by the created charge field feeding in from the right. It also creates a deficit felt by the ambient field outside the substance *on the left*. Both will wish to fill that deficit, and the strength of the Hall voltage will depend upon how low that deficit is relative to the ambient field.

So, as you see, I have shown *two separate causes* for our reverse motions on the left side. We don't have one field causing reverse motions by magic or incantation, we have two fields. We have the B field manufactured by the researchers, which creates a motion vector left; and we have the ambient field at the left boundary, moving right. The motion of the ions is an integration of the two fields, which matches data.

My charge field mechanics explains data in another way as well. There is just so much this reverse bias can push the electrons back, and that limit is caused by the feedback mechanism inherent in this process. Obviously, since you are borrowing photons from the left side to funnel in from the right side, your second B field is a function of your deficit (and vice versa). Unless your field is leaking somehow, your deficit must determine the strength of your B field.

In conclusion, I have once again been able to solve this problem while staying logical and mechanical. I have remained consistent to my own field definitions and postulates, something the mainstream quit doing a century ago. But I could do that only by postulating the charge field as a real field of photons—photons with both real radius and real spin. Since this was my first attempt at a solution, I suspect it will require further fine tunes. I may not have everything right here. But I think you can see my solution is already far more elegant and consistent than the mainstream solution; and if it requires further tuning, it is clear it has all the mechanisms that will allow that tuning to succeed. Just for a start, we have spins on the photons in the second field I didn't much use. This is my method when solving this way: I start by trying to explain as much as I can with linear motions, using photon spins only when absolutely necessary. It has worked in the past and I now trust my intuition. But if you see problems and solutions I don't yet see, fine, go to it. I am not selling this at a high price as dogma. I am offering it for free as a suggestion.