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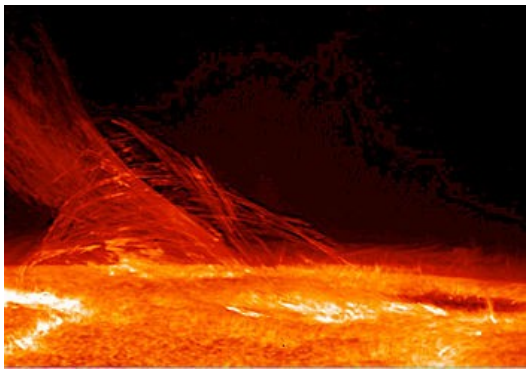
Magnetic Reconnection
and
Coronal Temperatures



by Miles Mathis

The current theory to explain the extremely high temperatures of the Solar corona is called magnetic reconnection. Since the atmosphere of the Sun cools off to about 4,000K at 500km but then heats up again to 20 million K above that, we certainly need some theory to explain it. That's as hot as the core, and may be even hotter. And it is actually pleasing to see mainstream theory use a form of magnetism to explain it, since I will show that is the right answer. Many people probably think I enjoy watching the mainstream get everything wrong, but I don't. It bothers me to see so much bad theory, and readers should read my anger as an outcome of that bother. If I only wanted them to be wrong and me to be right, I wouldn't get so bothered by their being wrong, would I? I am perfectly happy and content when I find the mainstream correct about something, since it gives me one less thing to do, and I only wish they were correct more often.

That said, I have to admit my pleasure was short-lived in this case, which should be obvious since I am here writing again. If they had this all right, I would be doing something else. You will no doubt share my displeasure when you read this:

In two dimensions, the most common type of magnetic reconnection is separator reconnection, in which four separate magnetic domains exchange magnetic field lines. Domains in a magnetic plasma are separated by separatrix surfaces: curved surfaces in space that divide different bundles of flux. Field lines on one side of the separatrix all terminate at a particular magnetic pole, while field lines on the other side all terminate at a different pole of similar sign.

That is our introduction to “magnetic reconnection” at Wikipedia. But don't blame the anonymous writers at Wikipedia: they are just repeating what you will find in textbooks and professional journals. The writers of the textbooks and journals probably wish they could be anonymous, too, since surely no one likes having to write this sort of garbage. If they had any kind of logical or mechanical explanation, they wouldn't feel the need to publish stuff like this. But there is a hole to fill, and

someone gets assigned the ugly job of filling it.

I often get blasted for using Wikipedia as a source for quotes, but these people should be thanking me. By writing my papers this way, far fewer actual names have to be used, and far fewer living people have to be embarrassed. I don't mind attacking people by name, but I prefer to save that sort of focused ire for the big guys who are responsible. In most cases it isn't worth naming the rank and file physicists, who—for the most part—are just doing their jobs. They didn't come up with this poor theory, they just report it. Unless they attack me, I leave them alone. I have some hope of turning them against their masters, so I actually take some pains *not* to name them.

But back to the quote. As you see, the theory of magnetic reconnection is completely non-mechanical, heuristic, and *ad hoc*. It is caused by "domains exchanging magnetic field lines." That one sentence begs so many questions it is hard to know where to start. What causes the field lines? What is magnetism? What are domains? How can domains exchange field lines? How can magnetic field lines be exchanged? We are told,

In an electrically conductive plasma, magnetic field lines are grouped into 'domains'— bundles of field lines that connect from a particular place to another particular place, and that are topologically distinct from other field lines nearby.

OK, but why and how are they grouped into domains? What happens at the edge of a domain? Why the switch at the boundary, and what causes the switch? We are told that field lines terminate at poles, but what causes the poles and the lines? If magnetism is a field, what is in the field? Magnetism is a field of what? Field lines are supposed to *represent* something—what do magnetic field lines represent? No answer here or elsewhere.

And there's another big problem:

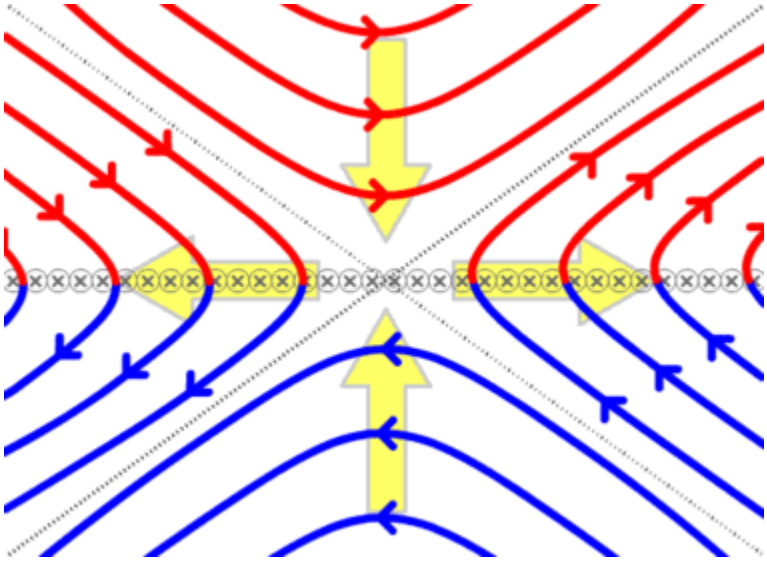
[Magnetic reconnection] is a violation of an approximate conservation law in plasma physics, and can concentrate mechanical or magnetic energy in both space and time.

That is all we get on that at Wikipedia, but at least they admit it. And how does this violate any laws?

Solar flares, the largest explosions in the Solar System, may involve the reconnection of large systems of magnetic flux on the Sun, releasing, in minutes, energy that has been stored in the magnetic field over a period of hours to days.

From this, you see that it isn't really conservation laws that are broken, it is laws of logic or consistency. There is no law against concentrating energy, but you have to have some mechanism for it. How can magnetic fields "store" energy, and how is the reconnection made that releases it? Since we have no mechanics in this field, we have no possible explanation for such things.

To go with these content-free explanations, we get content-free diagrams:



We are told that these magnetic field lines are “splicing” together along that zipper. How and why? What do the vectors represent? What is moving along the red and blue lines and what is moving along the yellow lines? In real fields, vectors must be assigned. But in magnetic theory, they are all floaters. Under this diagram, they admit:

This process is not well understood: once started, it proceeds many orders of magnitude faster than predicted by standard models.

It is refreshing to hear that, and it is why I am a little less angry today than most days. It only takes a small dose of honesty to calm me down. But all forms of this theory dodge any mention of field mechanics. We get talk of flux, ions, and electrons, but no mention of photons or charge. If field lines are representing the motions of electrons, for instance, what is driving the electrons? And if the red and blue lines are electron motions or potentials, what are the yellow lines? What in the field is moving that way and what is causing it to move? Drawing a bunch of vectors in the void is no help. If you can't assign your vectors to something, it is probably best not to draw anything. We want physics here, not signage.

As usual, to avoid these questions, the page at Wikipedia almost immediately diverts you into math, and briefly describes two very old, very naïve models: the Sweet-Parker model and the Petschek model.

At a conference in 1956, Peter Sweet pointed out that by pushing two plasmas with oppositely directed magnetic fields together, resistive diffusion is able to occur on a length scale much shorter than a typical equilibrium length scale.

Yes, but why? That is just a report of an experiment. It means that when the two plasmas were pushed together, something happened at a shorter length scale than predicted. It does not tell us how or why that happened. The rest of this model is just math, and it is admitted that the math of the

Sweet-Parker reconnection allows for reconnection rates much faster than global diffusion, but is not able to explain the fast reconnection rates observed in solar flares, the Earth's magnetosphere, and laboratory plasmas.

So, to recap, we have a theory that has not advanced since 1956, that has no mechanics, explains nothing, and that cannot match data. Then why are we reading about it 57 years later?

What about the Petschek model?

In 1964, Harry Petschek proposed a mechanism where the inflow and outflow regions are separated by stationary slow mode shocks. . . Simulations of resistive MHD reconnection with uniform resistivity showed the development of elongated current sheets in agreement with the Sweet-Parker model rather than the Petschek model. When a localized anomalously large resistivity is used, however, Petschek reconnection can be realized in resistive MHD simulations. Because the use of an anomalous resistivity is only appropriate when the particle mean free path is large compared to the reconnection layer, it is likely that other collisionless effects become important before Petschek reconnection can be realized.

To say that directly, even their simulations couldn't show these slow-mode shocks (and simulations can be made to show almost anything). The only way to begin to speed up the process was to use huge localized resistance, but since there should be no way to create this resistance at the boundaries of planets and the Sun, this theory is also a non-starter. How can a vacuum provide a "localized anomalously large resistivity?" Why are we reading about Petschek 50 years later?

Which takes us back to the initial definitions. To get a "reconnection," we first need a separation, right?

The intersection of the separatrices forms a separator, a single line that is at the boundary of the four separate domains.

So how does the Solar corona create these four separate domains? We have seen in all these explanations and models that we need at least two plasmas meeting to create the separator. But the Sun is just one plasma. Where is the other? The Solar plasma should always be moving out from center, no matter its flux or density, especially at the height of the corona. The Solar wind is moving out quite positively by that point. What is moving in? According to the mainstream models, the Sun is emitting into a charge vacuum, or near vacuum. It is also emitting into an ion vacuum, or near vacuum. The charge and ions in the Solar system are said to have been put there by the Sun itself, and are currently given to the Solar wind itself. So what second plasma is meeting the Sun's plasma head-on, according to this theory of magnetic reconnection? What magnetic field is moving in toward the Sun here, and why?

And even if they could point to that second plasma, they would have to come up with something better than field lines and separation lines. Right now all they have is a garbled way of saying that plasmas meeting can cause anomalous effects. Yes, that is true, but why? Switching from classical theory to plasma theory doesn't really tell us anything. It is just renaming the field a plasma. Creating a new set of names is not a physical theory.

Even the plasma people don't seem to understand this. They are quite proud of themselves for having worked with plasmas, and for seeing more clearly than most in the mainstream that many anomalous effects must be given to the E/M field, instead to the old gravity-only model of celestial mechanics. But their models are just as bare as the mainstream models. The mainstream is beginning to import some of the plasma models, but it isn't doing them any good: the plasma models don't have any mechanics, either. The plasma models boil down to this: it is plasma or E/M that is causing that, not gravity. True, but not very enlightening as physics or mechanics.

While the plasma people don't have much, they do have something here the mainstream doesn't. They have the possibility of a second field. Most plasma physicists understand that space isn't anything close to a vacuum. They understand the huge potential of space, though most can't say what causes it. Refreshingly, most plasma physicists don't seem to give this potential to a Dirac field, a Higgs field, or any other sort of virtual field. Those that do aren't helpful at all.

Which brings us to why I am here. I have shown my readers in scores of papers the cause of this potential in space. It isn't a Dirac field, a Higgs field, a zero-point energy field, a nebulous or mysterious ether, dark matter, hidden-sector field, neutrino field, or WIMP field. Nor is it some undefined field differential between the Sun and distant objects or distant space. It is simply charge—the same charge in Coulomb's equation, the same charge that is moving through the nucleus, the same charge that is "on" the electron. This charge isn't carried by virtual photons, messenger photons, neutrinos, or any other mysterious particles unknown to us. It is carried by the real photons we already know about in the spectrum. The "hidden-sector" actually exists in the known spectrum, and it is "hidden" only in the sense that it is poorly understood. Nothing remains as incomplete as our knowledge of real photons, that is, and it is this incomplete knowledge that rears its head on a daily basis, stopping all new theory in its tracks.

It is probably worth mentioning here that part of the problem has always been that we have named the photon spectrum the "electromagnetic spectrum." As I have shown, that is beyond imprecise. It is simply wrong. When drawing and theorizing about the electrical and magnetic fields, physicists have always been following ions, not photons. We see that again here, with the diagram above. No photons or photon fields are being diagrammed or discussed. If the vectors are following anything, they are following electrons, not photons. The equations of electromagnetism are equations that represent ions, not photons. All the variables on the "magnetic reconnection" page are variables that apply to ion fields: E, B, J, ∇, and so on. Maxwell's equations apply to ion fields, not photon fields. But then the "electromagnetic spectrum" is assigned to a spectrum of photons. This is a major reason that photons have been overlooked in modern theory. We think we already have equations for them, but we don't. The photon field is beneath the ion field, and drives it, but none of our field equations actually apply to it. Modern theory acts like charge and E/M are the same thing, but they aren't. Charge is photons, E/M is ions. They are far from equivalent.

Modern theory conflates photons and electrons in its field theory. This was always true back to Maxwell, but Bohr accelerated the confusion in his equations, as I have shown. Bohr actually made mathematical errors, mistaking his variable assignments. He fudged from p to Δp—from momentum to change in momentum. Since the change in the momentum of the electron is represented by the photon in his equations, it means he fudged between photons and electrons. This is why the photon has been ignored for most of the century. It is why physicists now can't figure out that dark matter is just photons.

The spectrum should be called the photon spectrum, the charge spectrum, or the light spectrum. It shouldn't be called the electromagnetic spectrum because the E/M field is an ion field. The light spectrum underlies and causes the E/M field, but it isn't equivalent to it. Charge *causes* E/M, but charge is not E/M. Charge and E/M are two separate fields, and you can have charge when no ions are present. It is much harder to *measure* charge with no ions present, which has been our problem historically. But an inability to measure is not an indication of non-existence (as has been assumed). The existence of the charge field in space can be inferred from tons of other conspicuous data, as I have shown over the past decade.

Since the photon is six billion times smaller than the proton, this incomplete knowledge is not altogether surprising. It has taken us over a century to get used to the idea that things exist that are a billion billion times smaller than us (electrons). Adding another billion to that is a third boggling that most cannot countenance. So while theorists have boldly theorized on almost everything else—no matter how dippy or absurd—they have refused to theorize about the photon. Possibly this is also explained by the fact that what was needed was straightforward *mechanical* theorizing about the photon—giving it real spins and real dimensions and things like that. That sort of theorizing has been out of fashion since the 1920's. Out-of-fashion or outlawed. This left photon theory to me. I like to think the Muses of physics left photon theory to an artist on purpose. Photons are light, and the traditional art I do concerns capturing the subtle effects of light on surfaces. My opponents like to pretend they see no connection between art and physics, but my allies see it without prompting.

At any rate, I have long had a simple mechanical theory for charge effects: it has been part of my unified field for years. But until now I have not connected it to the corona. Even when I wrote a paper on the Sun a couple of years ago, I had nothing much to say about the creation of the coronal energy. But now that I have used the charge field to explain the brightness of planets, moons, and comets—via magnetic interaction—I now have a mechanism for the corona. Some of my readers understood me immediately, and made the connection before I even got here. They wrote and asked me if the brightness of Enceldaus was linked to the heat of the corona. Rather than just say "yes," I decided to write this paper for *all* my readers, making the connection explicit.

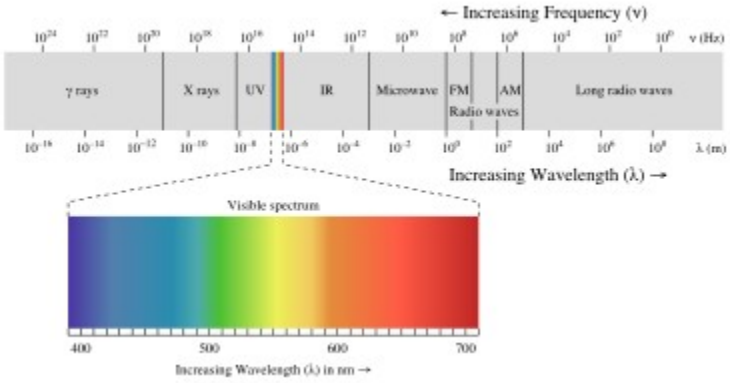
In those previous papers on comets and moons, I showed how the spins on the photons could cause the unexplained brightness. We only require photons meeting anti-photons, and charge recycling—along with an ambient field—was able to explain both. In short, all spherical bodies from electrons to galaxies recycle charge. The spin of the sphere in an ambient field naturally creates field potentials which draw photons in at the poles and emit them most heavily at the equator. This emitted charge then rejoins the ambient field at a boundary, and this rejoining can cause spin cancellations. In the right circumstances, these spin cancellations can cause big effects, and that is what we are seeing with increased brightness. It is also what we are seeing with the corona.

As you can already see, my theory parallels mainstream theory in many ways. It is magnetic, it requires fields meeting head-on, and four "fields" are involved, in a way. Since all natural charge fields contain both photons and anti-photons, both the emitted field and the ambient field will contain both. If we have two fields that are both polar, we can say we have four fields. However, my interaction would work even with only two fields. Or, it would work even in the case that the emitted field were all photons and the ambient field were all anti-photons. In this sense, the other two fields in the mainstream model are redundant. In practice, they are there; but they don't *have* to be there. The double chirality of the meeting fields can *enhance* the effect, but it isn't necessary to the effect. The effect is caused by spins cancelling, and that would happen even if we had only two fields instead of four. I hope that is clear.

Let us see if we can do some math to show the brightness effects on the planets and moons are caused by the same thing as the temperature effect in the corona. We found a temperature in the upper atmosphere of Uranus of 850K, and we find a temperature in the corona of 20 million K. What is the charge differential of the Sun and Uranus, according to my unified field calculations? All we have to do is compare mass and density, which gives us a differential of 25,400. The Sun recycles that much more charge than Uranus. If we multiply that by 850K, we get 21.6 million K. We have a match. Whatever is causing the two effects causes the same size effect, following charge. This strongly

indicates that charge is the cause, and that the two effects are related.

However, we see that the effect on Uranus and Enceladus and the Moon and many other bodies has a peak in the visible, whereas the corona effect does not. We don't see blinding brightness from the corona. Its energy peaks elsewhere. Why? Well, visible light is actually on the high end of the spectrum.



As you see, the middle of the spectrum is in IR, infrared. And I have shown this is where charge peaks as well (for the same reason). Charge has an average energy in the infrared, and so does the entire spectrum. If you averaged all the energy in the universe, that average photon would be infrared. I didn't discover this just from finding the median on this chart, I actually calculated it from classical numbers; but in fact you can get the information from this chart, by just a glance. It turns out the average is a bit more energetic than the median, since this chart by itself would indicate a median frequency of about 10^{12}. The average charge photon is a bit more energetic than that, but that number is close.

At any rate, what this tells us is that it is the visible light of Uranus that needs explaining, not the invisible light of the corona. If you bring two charges fields together, your first expectation would be a peak in the infrared, since that is where the two charge fields are peaking. If the colliding photons are infrared to start with, then we would expect them to remain in the infrared as they are scattered. If the spins are at an infrared energy, then when they are stripped, they should release at that level as well. So why do magnetic effects with planets and moons peak in the visible? It seems that smaller bodies should peak at lower energies, doesn't it?

But this difference isn't explained by the mass or the size of the body involved. The peak energy is determined (mainly) by the polarity of the field. Remember, I have shown that the farther we move from the Sun, the more anti-photons we find in the field. This is caused by the Sun's spin. The Sun is spinning in one direction and not the other, so its spin tends to turn anti-photons into photons. In other words, the Sun magnetizes the field. If you have a field that is balanced between photons and anti-photons, you have no overall magnetism: all the spins sum to zero. But the more imbalance you have, the more magnetism. The spin of the Sun creates imbalance, and a more magnetic field.

As we move out from the Sun, this imbalance dissipates. The Sun's emitted charge spreads out, losing density, and more charge from outside the Solar System creeps in. Since this charge hasn't been recycled through the Sun, it is more balanced. In short there are more anti-photons as a percentage of the total at the distance of Uranus than there are in the corona. The corona has 10 to 15%, Mercury has about 20%, the Earth about 33%, and Uranus about 45%.

What this means is that when you bring photons together with anti-photons, you have a greater or lesser potential difference. Just think about it: if you have 90% photons and only 10% antiphotons, your total energy potential in any one area will only be at 20% maximum. Maximum energy production would be with 50% photons and 50% anti-photons, since you would find the maximum number of spin collisions in that case. But with 10% antiphotons, you will find only $1/5^{th}$ as many collisions.

If Uranus has 45% anti-photons, then in that field we would expect about 90% maximum. This means that the Solar corona interaction would create only 22% the energy *per collision* that the Uranus interaction would create. Therefore, if the corona is peaking at an energy in the infrared, the interaction on Uranus will be peaking 4.5 times higher, which would push some of the radiation into the visible. This would be true even at the distance of Venus, where the interaction would push local energies 2.7 times higher than those at the corona.

Some will say, "That doesn't make sense. The energy levels have to be higher nearer the Sun, since we can see the fabulous temperatures of the corona." Yes, the *total* energy levels have to be far higher, since the Sun's total charge field is much bigger and denser. But the frequency of the emission is determined by neither the field size nor the field density. We are only trying to explain the frequency here, not the total energy of the field. The frequency is determined by the local field differentials, as I have shown. It is caused by charge imbalance, not charge strength. Which is why I used charge strength differentials to show the temperature difference, but used charge imbalance to show the frequency difference. Temperature is a function of the total charge field, while frequency isn't. You can have high frequencies in very tenuous fields, provided you have the method to create them locally. And you can have relatively low average frequencies in a very hot field, as we see from the Solar corona.

And we have another factor at work here. Although the charge field of the corona is both very dense and very big, the matter field there is not. In terms of "atmospheric" density, the corona is extremely tenuous, having only a few million particles per cubic centimeter. Since the other interactions we have looked at all have more matter involved—either being in upper atmospheres where the particle density is thousands of times higher, or being at actual surfaces where the density is millions of times higher—these interactions again have more local punch. Matter always has the effect of focusing the charge field, so any matter involved must act as a sort of accelerator to the previous mechanism I outlined above.