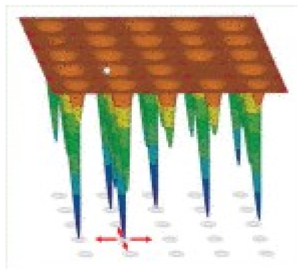
[return to updates](#)

An Analysis of Anderson Localization

A DESTRUCTION

and a replacement



by Miles Mathis

First published October 21, 2014

As with the problem of albedo we looked at in the case of excessive brightness from Enceladus, this problem of Anderson localization came about due to brightness unexplainable by mainstream theories of light propagation, particularly wave interference. Or, I should say, that is one of many things it is now used for. Originally, this idea of localization arose to explain data from Bell Labs in the late 1950's showing very long relaxation times for electron spins in doped semiconductors. Since the mainstream didn't have a real charge field to work with at the time (and still don't), they had to try to explain this using only electrons. To understand what I mean by that, you should first read my paper on the Drude-Sommerfeld model of electron transfer, and then read my paper on the dielectric. In those papers, I show that by using a real field of charge photons, we can explain all anomalous data quite easily, without any of the virtual-field fudges used by solid-state physicists since the 1950's.

To explain this large relaxation time in 1958, Philip Anderson proposed a complex series of mathematical and theoretical pushes by which electrons "are localized by a random well in the landscape of the random potential energy." In short, the electrons were paused by this faux-mechanism, preventing conduction. Before moving on to the right answer, we will stop to analyze the theory of Anderson localization, such as it is.

We will look at a couple of online sources, but we will start as usual with Wikipedia, to see the sort of misdirection we are getting to this day from the mainstream. The page at Wiki has several sections. The first section has no content other than this:

Anderson localization, also known as **strong localization**, is the absence of diffusion of waves in a *disordered* medium.

Even that has slight content, since "an absence of diffusion waves" is both flabby and—as it turns out —false. Anderson localization is the attempt to keep electrons from transmitting through a material, but since conduction was never the transmission of electrons, there was never any need for localizing electrons. They know good and well that conduction isn't the motion of electrons, and have known it for decades. Some in the mainstream are nice enough to admit this in the matter of conduction through a wire (see my paper on the battery circuit), but when we go to conduction through other material, they ignore it completely. They have to ignore it, because in solid-state physics they have no other way to solve these problems. Their teachers taught them the Drude-Sommerfeld model, so all they can think to do when new problems arise is jerry-rig that model over and over. They never consider the possibility that the model is wrong from the foundations, because that would require them admitting that electron transfer is not responsible for conduction of any kind. And if they admit that, they are put in the position of answering what *is* responsible for conduction. Without a real *mechanical* charge field, they cannot possibly do that.

The second section at Wikipedia is another red flag, since they feel the need to dump a load of undefined math on your head. Before they have even defined the problem or glossed the solution for you, they plow you under with this math. This is the go-to form of misdirection in physics, and has been for almost a century. Although Richard Feynman didn't invent this method (he inherited it from his teachers like Pauli), he was the unquestioned master of it. I have shown how he set up his lectures just like this Wikipedia page, hitting his graduate students in the first weeks with as much difficult math as he could, to soften them up and confuse them, before he ever got around to defining the problem.

You don't need the Schrodinger equation or any other Hamiltonians to explain the relaxation times here, you just need the charge field. As I showed in my paper on the dielectric, we have to follow charge through the material, not electrons. If we do that, we also don't need any tunneling, virtual fields, or other fudges. The long relaxation times found at Bell Labs were the result of longer charge paths, caused by the way the nuclei in the material were recycling *real* charge photons. But Anderson didn't have that to work with. He didn't know that the nucleus was channeling real charge through it in defined channels, so he had to finesse another answer.

To see how ugly and inelegant that answer is, you just have to read section three at Wikipedia, where we are assaulted with sentences like this:

For non-interacting electrons, a highly successful approach was put forward in 1979 by Abrahams *et al.*[2] This scaling hypothesis of localization suggests that a disorder-induced metal-insulator transition (MIT) exists for non-interacting electrons in three dimensions (3D) at zero magnetic field and in the absence of spin-orbit coupling. Much further work has subsequently supported these scaling arguments both analytically and numerically (Brandes *et al.*, 2003; see Further Reading). In 1D and 2D, the same hypothesis shows that there are no extended states and thus no MIT. However, since 2 is the lower critical dimension of the localization problem, the 2D case is in a sense close to 3D: states are only marginally localized for weak disorder and a small magnetic field or spin-orbit coupling can lead to the existence of extended states and thus an MIT.

Once again, as scientists we have to be embarrassed that anyone is trying to pass off such things as physics, much less getting Nobel Prizes for them. Anderson, Mott and van Vleck got the Nobel Prize in 1977 for their work on this solid-state fudging. To get a somewhat clearer picture of what these guys were doing, we can go to this 2009 article at *Physics Today* entitled “Fifty Years of Anderson Localization.” There, we find this quote from Anderson's Nobel lecture:

Very few believed [localization] at the time, and even fewer saw its importance; among those who failed to fully understand it at first was certainly its author. It has yet to receive adequate mathematical treatment, and one has to resort to the indignity of numerical simulations to settle even the simplest questions about it.

That has the same curious tone of many Nobel lectures we have seen, where the recipient seems abashed or confused by his own promotion. Some will just say that is a sign of his modesty, but these quotes are psychologically far richer than a case of modesty. Anderson is telling us something here, if we will just read it right. What he is telling us is that he sees his own theory as *undignified*, since it requires a series of complex and illogical mathematical pushes, pushes that had still not been codified and justified 17 years after their birth (and now 55 years after). Notice he carefully chooses the words "numerical simulations." He uses those two words instead of "math," and I assume he does that to indicate that the undignified finesses applied to this problem by his co-workers don't really qualify as math. The original problem of a long relaxation time was not that difficult, and should have fallen to a much simpler explanation and math, and Anderson seems to realize that. We have seen he was right, since my solution is orders of magnitude simpler than the mainstream solution, both in math and theory.

Even more, I read Anderson's quote as an indication that he *still* doesn't believe in localization, and isn't convinced of its importance—which would be to his everlasting credit. His tone implies he is under pressure from above to go along with his own promotion, since it works as promotion of the mainstream, but I have no confidence Anderson believes in localization himself. Why should he? At a glance, anyone can see it is the opposite of elegant, and it is immediately cut by a thousand wounds from Occam's Razor. It also boldly contradicts at least a dozen things they already knew about conduction in 1960 (only one of which is the non-transmission of electrons), and a dozen more we have discovered since then. As just one example, we have seen in my paper of 9/19 an announcement from *APS* of photon interaction that I have shown blows decades of solid-state physics, including BCS and RVB theory. Well, you know what else it blows? Anderson localization. All new experiments have falsified the underlying Drude-Sommerfeld model, and since Anderson's work was built on that, it has crumbled like the rest.

Just look at one of the first sentences of the *Physics Today* article:

The study of the conductance of electrons belongs to the very heart of condensed-matter physics.

Yes, and that is why condensed-matter physics has devolved into nothing but a pile of fudges. Since conduction isn't the conduction of electrons, the heart of all this is pumping no blood. Conduction is the conduction of charge, which is photons, not electrons.

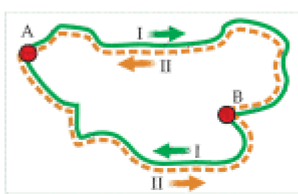
To remind you of the enormity of those fudges, *Physics Today* tells you,

Physicists had to wait for the discovery of quantum mechanics to understand why electrons apparently do not scatter from ions that occupy regular lattice sites: The wave character of an electron causes the electron to diffract from an ideal crystal.

Hah! In quantum "mechanics", the electron doesn't interact with the material it inhabits, it interacts with an ideal crystal. In other words, it interacts with a picture in a book. That is like saying that when you have sex, you don't have sex with a real woman, you have sex with a Rodin sculpture:

This is just more proof that quantum non-mechanics isn't physical. It is the faux-coupling of real particles with ideal structures, and then the finessing of those structures with a series of cheats. It doesn't actually resemble physics or any other science in the least.

We have already seen how awful these cheats are in previous papers, but I suppose it might be worth hitting them again here, since the *Physics Today* article lays them all out on the lawn in their full disarray. First, the author glosses weak localization. This is the push that doubles the localization of the electron, by making it exactly twice as likely the electron is back where it started. Unfortunately, any logical analysis shows this is just a cheat. The primary reason it is a cheat is that it requires arbitrarily choosing a "starting point". By summing the forward and backward path, the mathematicians pretend that the odds of returning to point A are double. But in truth, the odds are unchanged, since you could just as easily choose point B as the starting point—in which case the odds would double for localizing at B. That wouldn't help them, because they don't want to localize at B.



The main trick here is proposing a loop when we have no indication of one in real life. At the beginning of this paragraph on weak localization, the author says,

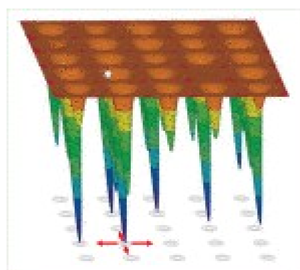
Imagine a wave that travels from point A along a random path to point B and then goes back to A.

Unfortunately, nothing in mainstream theory or data ever indicated such a loop. If electrons were making loops in materials, you could never have conduction regardless. To ever get any conduction, the electrons would have to move from A to B. And, given any E/M field, that is what we see. The entire Drude-Sommerfeld model relies on linear motion of electrons *across* materials, not closed loops, so this first assumption of a loop is dishonest in the extreme. The loop is proposed only so that this summation can be doubled by constructive interference.

But even that interference is a fudge, since in a random or disordered field, there is no reason to suppose you would get constructive interference. To get constructive interference of waves, you have to have crests meeting, and in a disordered field there is no reason to assume crests would meet. Only if A and B were some number of wavelengths from one another, and both the forward and backward paths were of a determined length—determined again by the wavelength—would you get constructive interference. You would be just as likely to get destructive interference in a random field, with no constraints on A and B. So again, this is all just a push.

We should have known it was a push even without all that, since this push only gives us a straight doubling. That isn't what we see in data. We don't see either a field or its double, so weak interference doesn't explain data. Once they have the doubling, they then have to force the numbers together by other *ad hoc* tweaks, which is further indication of fudging.

Weak localization only gives them electrons twice as likely to be found around A, so how do they get to strong localization?



The Anderson model. Imagine an electron (silver) hopping on a two-dimensional lattice with random potential energies at each site. Quantum mechanics allows the electron to tunnel from one site to another through large energy barriers as depicted by the red arrows. The electron's energy thus changes randomly, although at each lattice site the spatial extent of its wave-function (sketched below the potential) is assumed constant, leading to a constant tunneling rate. On an ordered lattice with all wells the same depth, the electron would be completely mobile for a range of energies. But here, a critical amount of randomness in the well depths localizes the electron, although on a scale larger than the lattice constant.

Twenty-two years after Anderson's Nobel Prize, and that is the best gloss they can come up with? An electron hopping on a 2D lattice? A critical amount of randomness localizes the electron? Does anyone in physics honestly think this is how conduction occurs in real bodies? My question is, how horrendous would this theory have to get before they would agree to ditch it? How many times would it have to be disproved by experiment before they would agree to ditch it? Nothing in the history of science has ever stunk worse than this. The orreries of Aristotle were sweet-smelling compared to this. Just think how low the editorial standards must be at *Physics Today* to allow paragraphs like this into print in a magazine ostensibly sold as a science magazine.

To see yet another example of this stink, the author of the 2009 article later admits that the problem Anderson was trying to solve couldn't be solved with electron loops, and that "that loops are, in fact, not crucial to localize the electron." Then why is this author starting his analysis with these loops 51 years later? Is our brain just being stirred as some sort of crazy game?

Since localization can't be shown with loops, Anderson and his postdocs dumped that idea and changed to "electrons hopping randomly on a Cayley tree." Although the author admits that this was "a somewhat artificial but useful fractal model in which it's impossible for an electron to return to the same lattice site except by retracing exactly the same path," that didn't stop anyone. Nor did the fact that "the fractal model erroneously predicted a phase transition in 2D metals." Erroneous predictions can be fudged over in a twinkling in new physics, as we know.

One of the ways they did this was by manufacturing a controversy. When your math and theory is garbage, the best thing to do is manufacture a controversy, since that diverts attention away from the models and toward the squabbling physicists. Everyone would rather read about a squabble than read real physics, you know. Anderson's Nobel colleague Mott's theory conflicts with the scaling theory of localization of Abrahams, et. al., and so we have had to read reams of fake debates in the professional journals since the late seventies. Problem is, all these models are still based on the electron, which means we can dismiss them without further consideration. Charge isn't conducted by electrons, so we have just seen another tempest in a teapot. All these people are fantastically, *spectacularly* wrong, and the complexity of the models and math only makes the theories that much more absurd. The time wasted on all these models—models that any high school student could see are cracked—points to a physics that has quite simply crossed over into mass pathology and delusion. Again, all these prominent people should have known all along that charge wasn't being conducted by electrons, and I assume they *did* know it. They have tracked electrons and have never found them moving like this. They don't move this way in wires, they don't move this way in transition metals, and they don't move this way in any other material. Their own experiments show this, and they admit it. And yet they still push on boldly and stupidly with these electron models. It is as if they believe all the Nobel Prizes awarded over the years can cancel or trump plain experiments. The Nobel committee has given millions of dollars to those who have sold us these electron models. What is real experimental evidence next to that?

But let's move on. That horse is so dead we could carbon date it. In my previous papers I have shown that conduction and the *speed* of conduction is a function of charge photons moving through material, not electrons. The electrons are just buoys in the field. As such, they may tell us a lot about charge densities and directions at given areas in the material, but tracking electrons is not the same as tracking charge. That is why we don't need tunneling, we don't ideal crystals, or any of the rest.

Unlike the mainstream theory, which treats any material as an ideal crystal and then fudges from there, in my theory we have to know exactly which elements we are working with. We have to know because we have to track charge as it passes through the nuclei of these elements. What causes these extended relaxation times isn't electron localization, it is longer charge paths through the nuclear structures. These longer charge paths are caused by element alignments that do not allow for through charge. This effectively stops conduction, as I showed in those previous papers by actually drawing the charge channels through a variety of nuclei and molecules. I also showed how the dopants are affecting these paths. If we then wish to calculate exactly how much these longer paths will interfere with charge, we don't look at manufactured numbers like the ones that come out of current theory. We start by looking at numbers like thermal conductivity, heat capacity, electronegativity, and so on: the numbers that describe the charge channeling abilities of each elemental nucleus. Using those experimental numbers and my nuclear diagrams, we can begin to understand the conductivity of given complex materials.

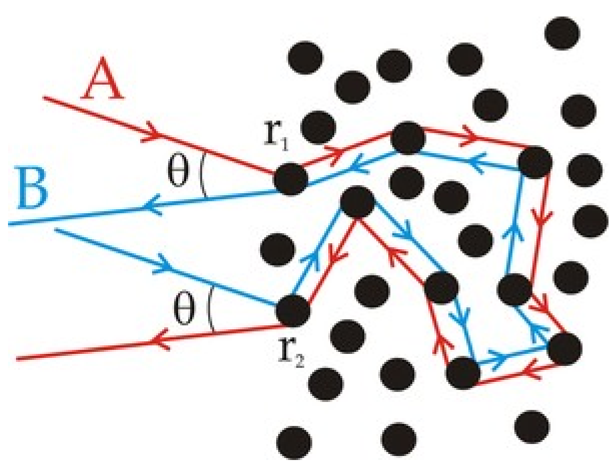
Since I have already shown you the method for that in previous papers, we will look at something new here. Anderson localization is now being used to explain things like the high production of light by bio-reflectors such as fish scales, as we see in this paper at the Royal Society in 2014. There we are told,

The theory of Anderson localization explains how waves become spatially confined in a disordered medium. It was originally conceived as a way to explain the transport properties of electrons in a semiconductor and the related behaviour of the quantum wave function [37]. The theory is now, however, understood to be a universal wave phenomenon that also applies to electromagnetic waves [38–40], matter waves [41] and acoustic waves [42]. The physical origin of Anderson localization is entirely due to multiple scattering and coherent interference [40].

Although that contradicts the actual theory of Anderson localization we have been studying, we won't dwell on that. Rather, we will take what this author says as true and see if it makes any sense. Let us throw out not only electron loops but also electron hopping on Cayley trees, just taking localization as being "due to multiple scattering and coherent interference." Does that have any hope of explaining the reflectivity of biological structures?

Nope. Why not? Well, I could analyze all the manufactured math and graphs in that paper at the Royal Society, but in this case I will cut to the chase. We don't need to pull apart all the fudges in that paper, since we can simply study the *definitions* of multiple scattering and coherent interference. I will start with the latter.

Again, I have already covered this in previous papers, but since I haven't connected my analyses there to this problem of bio-reflectivity, I will do that here. To get us started, we have to return to my second paper on Saturn's moon Enceladus, where I pull apart the idea of coherent interference as the cause of its extra brightness. If you will remember, Enceladus is reflecting light at 40% over unity, even according to the mainstream. This normally would mean it is reflecting more light than is falling on it, which obviously doesn't fit the definition of "reflect." *By definition*, you cannot reflect at over unity. To fill this gap, the mainstream calls the extra 40% "opposition surge," and then tries to explain opposition surge by several desperate means, the greatest of them being coherent interference. This is the same coherent interference they are using in the paper on bio-reflectivity, and it fails for the same reason. Remember this diagram and subtext, borrowed from the mainstream?



Propagation of two rays in a random medium. Since one can be obtained from the other by time inversion, they interfere coherently when the angle θ goes to zero.

As you see, they have to fudge you with time inversion to get this coherent interference. Otherwise, the interference, though coherent in a way, would cause less brightness, not more. What they really need is not interference, they need a boost, and they can't get it with mainstream physics and real analysis.

Another problem with this theory of coherent interference is that in bio-reflectivity, we are dealing with reflected light from the Sun, which is not coherent. Neither the light falling on the organism nor the light moving through the various layers is coherent. So the theory fails at a glance.

And the theory fails in yet another way. As you see, the authors at the *Royal Societ*y are borrowing theory from Anderson, but Anderson's theory concerned electrons. To fudge past that, they say that localization is now understood to apply to all waves. Unfortunately, Anderson localization actually didn't have anything to do with waves. Just return to these quotes from the 2009 *Physics Today* article:

Electrons are waves, of course. But rather than thinking of conduction electrons as extended plane waves with short lifetimes and small mean free paths, one should instead view them as standing waves that are confined in space and thus have long lifetimes. Moreover, not just one or two electrons are localized by a random well in the landscape of the random potential energy; nearly all conduction electrons become localized in concert. For each electron, the multiple scattering events add to cancel each other.

And,

The Anderson model. Imagine an electron (silver) hopping on a two-dimensional lattice with random potential energies at each site. Quantum mechanics allows the electron to tunnel from one site to another through large energy barriers as depicted by the red arrows. The electron's energy thus changes randomly, although at each lattice site the spatial extent of its wave-function (sketched below the potential) is assumed constant, leading to a constant tunneling rate.

Standing waves or localized electrons contradict the idea of traveling waves, and you can't get any interference from trapped waves. That is especially obvious in the second quote, where waves have been ditched altogether. I will be told that the authors at the *Royal Society* are not trapping waves like that, but since they are using Anderson localization, they must be. They even admit it:

The theory of Anderson localization explains how waves become spatially confined in a disordered medium.

If the waves are spatially confined, they cannot be interfering with other waves. The idea of localization conflicts with the idea of interference at the ground level, since trapped waves cannot be interfering with ambient waves. To get interference requires two waves, and neither of them can be trapped.

If you don't understand what I mean by that, remember that interference is an interaction. It requires the interaction of two separate waves. It is like any other interaction, which requires two entities. Instead of waves, let us have two particles *interact*. They can only interact if they come together, right? Well, if we trap, confine, or localize one of the particles, that means it cannot leave its local spot. If it cannot leave its local spot, how is it going to interact with other entities? It would be like being told that someone is having sex in solitary confinement. As usual, modern theory proceeds by simply ignoring the definitions of all words, even the simplest words like "interact." Confined waves cannot be interfering, except by some form of photonic masturbation.

The same applies to the term "multiple scattering," which is used to imply that multiple hits can create more brightness than a single hit. But keeping to conservation of energy and the old definitions, it can't. Only by fudging on the word "scattering" can multiple scattering even begin to address the problems we are looking at. To read more about this, consult my papers on Rayleigh scattering, where I show that the scattering there isn't really scattering. Since it is a mysterious spin-up of photon energies, it must be a form of anti-Stokes luminescence. Which is to say, it is again over-unity, with no explanation where the extra energy is coming from. "Normal" scattering like Rayleigh scattering was always over-unity, and multiple scattering is just the attempt to multiply that magic. Both multiple scattering and coherent interference are over-unity fudges, with only the appearance of a mechanism. In truth, neither of them have any rational mechanism, and both are raw pushes to data.

Which is not to say that these phenomena cannot be explained. They are quite easy to explain with the charge field. Both the brightness of the sky and the brightness of Enceladus fall to the same simple solution, and that solution also applies to the bio-reflectivity of fish scales and other materials. I showed in the paper on Enceladus that that moon is actually reflecting at 9 times over unity, not 1.4. The mainstream is hiding the extent of the problem, in order to save their standing models. So we have indication in our own Solar system that fields can be spun up 900% by photons meeting in an ionic environment. In more exotic environments, we imagine they can be spun up far more than that. What explains this is not wave mechanics, but spin mechanics. It is the spins on the photons we have to track. To do that, we simply follow my quantum spin equation, which tells us relative energy levels straight from stacked spins. Since photons are always going c, they cannot transfer energy with linear velocity. They can only transfer energy via spins, and these spins are quantized. To solve, we only need photon densities, and we can get those from the mass and densities of the larger bodies involved. For instance, in the case of Enceladus, we could do the rough math with only the mass and density of Enceladus and the Sun. Then, using the sort of math I do in my papers on Bode's law, axial tilt, and others, we can easily calculate the incoming and outgoing field densities.

To apply this to bio-reflectivity is obviously more complex, since we have many layers to analyze. But, as you see, we have to analyze each layer as a channeler of real photons with real spins, and use spin mechanics to calculate the interactions. Since wave mechanics is a sister of spin mechanics (the spins create the waves), we could still use wave equations in our solutions, provided we do them right. But to understand the *mechanics* of the real interactions, we should always start with the spins. You cannot understand anything about the wave nature of light without understanding how it is caused by spins at the quantum level. If you haven't yet fully understood that light is a spin wave, not a field wave, I suggest you read my old papers over and over until that becomes second nature for you. Once it does, all these experiments with light will click for you.