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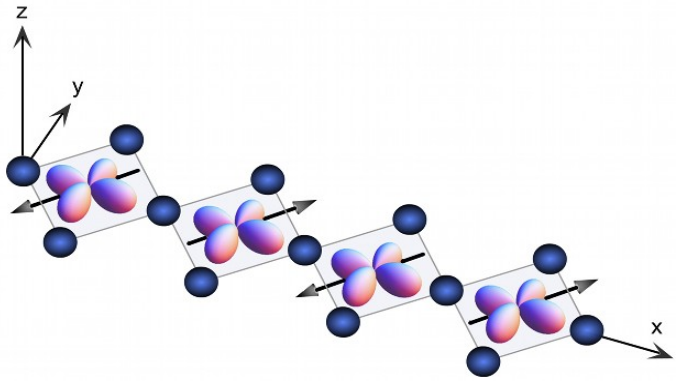
More on the Orbiton

a close reading of
the *Nature* letter



by Miles Mathis

In the May 3, 2012 volume of *Nature* (485, p. 82), Schlappa et al. present a claim of confirmation of the orbiton. I will analyze that claim here.

The authors begin like this:

When viewed as an elementary particle, the electron has spin and charge. When binding to the atomic nucleus, it also acquires an angular momentum quantum number corresponding to the quantized atomic orbital it occupies.

As a reader, you should be concerned that they would start off this important paper with a falsehood. I remind you that according to current theory, the electron does *not* have real spin and real charge. As with angular momentum, it has spin and charge quantum numbers. But all these quantum numbers are physically unassigned. They are mathematical only. The top physicists and journals and books have been telling us for decades that the electron spin is not to be understood as an actual spin, because they can't make that work in their equations. The spin is either understood to be a virtual spin, or it is understood to be nothing more than a place-filler in the equations. We can say the same of charge, which has never been defined physically to this day. What does a charged particle have that an uncharged particle does not, beyond different math and a different sign? The current theory has no answer. Rather than charge and spin and orbit, we could call these quantum numbers red and blue and green, and nothing would change in the theory.

Why do they admit that angular momentum is just a quantum number, but don't admit it about charge and spin here? As we proceed, ask yourself how they might be misdirecting you by doing that.

Also, since charge is undefined, the "binding to the atomic nucleus" must also be undefined. We are told the binding energy is charge, but if we don't know what charge is, that telling is empty. Bound how, by what physical mechanism? We are currently told that charge is mediated by messenger

photons (which are virtual). These photons can "tell" surrounding particles plus or minus. How does that explain binding energy? Can these virtual messenger photons also communicate energy levels?

Beyond that, do we really have any evidence the orbital quantum number corresponds to a nuclear orbit? No. That was just an idea Bohr had, to give us something to assign one of the degrees of freedom to. As with spin and charge, no one really cares if that idea is right. They haven't needed physical assignments for their quantum numbers, have they? If they needed them, they would have been careful to have physical assignments for spin and charge. Since we have existed without physical assignments for spin for about 90 years now, and for charge for about 230 years, we may assume the assignment of the orbital quantum number to a nuclear orbit is equally firm and important in the minds of contemporary physicists. In other words, they not only can't prove that assignment, they don't care to prove it. They don't care, period. They have no physics, only math, and the lack of physics does not concern them. Could that be how this theory of quasi-particles was born? Once your field becomes a field of numbers only—with no physical underpinning—it becomes quite easy to watch those numbers move off in separate directions without struggling for a real mechanical explanation. Just as they don't care to make sense of charge or spin, they don't care to make sense of this.

Next they tell us that "the separation of the electron into independent quasi-particles that carry either spin (spinons) or charge (holons) was first observed fifteen years ago." False again. There was no observation. As in this current *Nature* letter, there was only a claim of a match of data to a model, which is not an "observation." As usual, they treat a footnote as proof, but a footnote like this is just a pointer to another fudged experiment.

Then they say, "Here we report observation of ...the orbiton." No, they don't. Nothing in this letter even approaches an observation, as we will see. They are reporting only some anomalous data, unexplainable by the fundamental theory of quantum mechanics. To try to explain it, they simply assign existing degrees of freedom in their own new theory to the data. But they provide absolutely no evidence to confirm this assignment. In fact, they provide very strong evidence *against* that assignment, since in order to make the assignment they have to separate characteristics that cannot logically be separated. To make that assignment, they have to flog all the rules of common sense, of logic, and of physics. Then they have to pretend not to notice that they have disproved themselves, by their own contradictory patter.

The falsehoods continue in paragraph 2, which begins,

It was pointed out in the 1970's that in a solid, not only the charge and spin of electrons became ordered—leading to magnetism—but also the electrons' orbital degree of freedom. This observation sparked a field....

No. It wasn't "pointed out", it was theorized. A theory is not an observation. This sort of speech is purposely sloppy, and it is being used to misdirect you the reader. It is propaganda speech. Scientists should not write this way, but now they almost always do. You should ask yourself why physics has been taken over by propagandists. I will suggest an answer here: they wish for you to believe that an "observation" sparked a field of physics inquiry, since that implies that data led them inexorably where they are going. That isn't how it happened, historically. As with all the other fake subfields of physics, this one was created by nothing but a poor hypothesis, one that already falsified itself from the first word. But that didn't stop anyone, as we see. It sparked a new field anyway, from which we can infer that bad ideas are now used for job creation. Even the worst theorists are useful to physics, since just about any idea can spark a new field. Just as new physicists don't really care if spin and charge have any meaning, they also don't care if new theories are good or not. It is not the content of the theory that

matters, it is the sparking that matters. *Any* new field creates jobs and seeds papers, so any new idea will be embraced and spun out into decades of foolery.

But return to the last quote. Ask yourself how the charge and spin of electrons can become "ordered." If this is not real spin or real charge, what is being ordered? Quantum numbers cannot be ordered by a physical field, only real physical characteristics can be ordered. Real spins can be ordered by spin. How do you order virtual spin? What physical interaction is ordering it, via what motions?

Another question begged by this wording is how virtual ordering of virtual spin and virtual charge creates magnetism. That has never been explained. Since magnetism is a real quality, we may ask how virtual spin and virtual charge create real magnetism. Shouldn't they create virtual magnetism?

This analysis is not beside the point. It is not metaphysical or philosophical. My analysis is seeking the physical, so my questions are physical, not metaphysical. I am pointing out a complete lack of mechanics, so my analysis must be mechanical, not metaphysical. All these questions are very much to-the-point, since they directly impact the movement of the argument for orbitons here. The authors are trying to create a groundwork for their data, but as we are seeing, they are totally failing to do so. You can't create a groundwork for any "observation" with virtual particles, virtual fields, and virtual qualities, because all such virtualities are unobservable, *by definition*. That is what "virtual" means. Look it up. If the particles, fields, and qualities were observable, we wouldn't need to call them virtual. If they are observable, they are real. If they are virtual they are unobservable. So using the term "observation" in a paper dealing with virtual fields and quasi-particles is false from the first sentence. The entire argument is a non-starter.

The same can be said for the term "quasi." If any real physics were being done here, we wouldn't need the term quasi. Precisely because nothing here is observable, provable, or physical, we need the term quasi.

There is no possible physical definition of a quasi-particle. A thing is either a particle or it isn't. It is sort of like saying something is a quasi-rock. We have a definition of "rock," or should, and a thing either fits that definition or it doesn't. There is no possible entity as a quasi-rock. Say you had evidence of some rock-sized force. Say you had a dent in your car hood, about the size of a rock. But you have no evidence of a real rock. No one observed the dent being created. So you propose that your car was hit by a quasi-rock. Does that make any sense, either as science or as any other sort of intelligence? No. Your car was either hit by a rock or it wasn't. Many things besides a rock could have caused a dent that size, so calling the unknown thing as quasi-rock isn't helpful at all. If, with more research, you discover rock residue, then you may have evidence for a rock. If, with more research, you find white paint residue, you may assume it was not a rock, since rocks are not painted. Maybe it was a golfball. But no matter how much research you do, you will never find evidence of a quasi-rock. Likewise with a quasi-particle.

By paragraph 4, the nonsense has already crescendoed:

The spin-orbital separation process we are looking for is analogous to the spin-charge separation mechanism. The latter occurs, for instance, when an electron is annihilated, removing a single spin and leaving behind a hole in the antiferromagnetic chain. This hole can start to propagate freely only after exciting one spinon (a domain wall in the antiferromagnetic chain). Subsequently, the spinon can delocalize and separate itself completely from the holon.

As you see, they have simply taken the footnotes in previous paragraphs as proof, so that they may now claim that "the latter occurs." Someone came up with a theory, someone saw some data that seemed to fit it, so now we make take it as given and go from there. But you may ask how the annihilation of an electron can leave behind its charge and its spin. That is what they are telling you here, as you see. Why would an annihilated electron leave behind both its charge and its spin? If the electron can leave behind its charge (its holon) after annihilation, then charge must exist separately, must it not? It exists as what? What in the field represents or holds the charge? No answer. Although I don't think that is what is happening here, I could answer this question if I had to, since my charge field is made of real photons. But current theory doesn't have a charge field made of real photons, so it can't use that answer. Again, its telling is an empty telling. When they tell you charge remains after annihilation, you have to accept that as just a string of words.

Likewise with spin. The above quote doesn't even make sense regarding spin. First they tell you that a single spin has been *removed*, but then another one suddenly appears out of the domain wall. I don't see the point of that. If they want spin moving off separately, why remove it with the annihilation and then recreate it mysteriously out of a manufactured domain wall? I suppose it must be because something has to be annihilated with the electron. If the electron is "annihilated," but all of its characteristics remain, what has been annihilated? So they let the electron spin be removed with the annihilation, just to give some meaning to annihilation, then magically invoke a new spin out of a domain wall.

Notice the wording: a hole excites a domain wall, creating a spinon. That isn't physics, my friends. Exactly how can a hole excite anything? As a matter of sex, we might understand it: as physics, it is meaningless. In physics, an excitation must be caused, and it can't be caused by a hole.

They treat a domain wall as some sort of door-number-three, out of which you can pull spinons, with the right excitement. Problem is, they just made up the domain wall. A domain wall, if it is anything, is no more than an abstract border you create *in your math*, in order to represent a kind of limit to your particles' influence. Again, just look up the definition of "domain". It is a mathematical term, not a physical one. You cannot excite a domain wall, much less pull anything out of it in an act of creation.

And even if you could, why should your domain wall present you with a spinon as reward for your hole excitement, rather than, say, a moon, a clover, or a lucky charm? Are there any rules of domain walls, or will they give you anything you ask for, like Jeannie or Samantha?

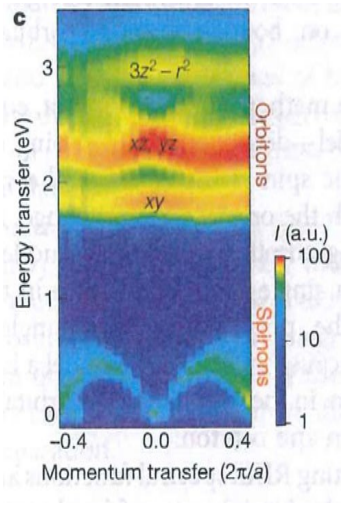
As for the "delocalizing," how can a domain wall move off through the field? If it moves, it isn't the domain wall anymore, right? And what exactly makes it a spinon? Is it spinning? Why? I thought the spin had been removed. Why is the domain wall spinning after the spin has been removed?

Anyone who reads this letter at *Nature* without laughing outloud is not paying attention. It is farce of the first order. This is why I always recommend that my readers actually read these famous papers. I don't shoo anyone off from the mainstream, as they do from me. I think everyone who is interested in physics should read these mainstream publications closely. They should read the original papers from the original authors, since no gloss or retelling can hope to recreate the drollery we find there.

The first real bit of meat we get in this letter is in paragraph 6, page 1, where the authors tell us that the "orbiton dispersion has a periodicity of π," indicating the presence of a liberated orbiton. Two things are curious about that. One, since this is a primary piece of evidence, it is curious that it is mentioned and then dropped so quickly, in the first instance. They sort of just slip it in there and then move on,

hoping, I suppose, that you won't see it as a central piece of this puzzle. Two, it is curious because it proves what I have been saying above: the orbiton is never *observed*. What is observed is the periodicity of π, which they claim indicates the orbiton. That is an inference, not an observation, and it is a very poor inference, as we will see.

For clarification of this periodicity, we are sent first to figure 1c, which I have copied here:



The subtext to this figure is

RIXS intensity map of the dispersing spin and orbital excitations in Sr_2CuO_3 as functions of photon momentum transfer along chains and photon energy transfer.

Absolutely incredible. Precisely what I was looking for when I began digging through this mess. Although they have labeled the right side of the graph "orbitons" and "spinons," the real labels are to the left and bottom, as we expect from such graphs. The real labels go with the numbers, you know, and you don't normally label an x,y graph like this on the right side. The left side label represents a real parameter, measured in numbers. The right side label is just a tack-on, and the numbers have nothing to do with those labels. Notice that they admit that what is being measured is photon momentum and energy. Their machine, RIXS, measures photons, not electron or orbitons. They tell you that "the dispersion of orbital and spin excitations can be mapped out across the first Brillouin zone." But that isn't what the graph is actually mapping. As you see, the graph is mapping photon momentum transfer against photon energy transfer. The assignment of these photon states to obitons and spinons is nothing more than fantasy. The actual data gives us *zero* evidence that this is what is actually happening.

Also notice the curious wording. The graph is labeled energy and momentum *transfer*. But remember that eV is a measure of energy, not energy transfer. Same for 2π/a. They are calling these numbers transfers, but that is just to seed the idea in your head that the photons are transferring energy to orbitons and spinons, although we have no evidence of that. So even their labels are propagandized. They *should* label them "photon energy" and "photon momentum." But they dump the word "photon" and add the word "transfer." That's just a hamhanded trick.

But all this is important not only negatively. It is important positively because it lends support to my previous paper, where I suggested that these experiments should be explained by photons, not by electrons. I suggested that before I even looked closely at the actual experiments. I suggested it based only on the short glosses that made the headlines this summer. Just from the outline I got there, I could

tell real charge photons were creating the data, not orbitons, spinons, or holons.

We have proof of that in this graph, because when you map photon energies against photon momenta, you obviously get a map of a photon field. Assigning this map to orbitons and spinons is sort of like creating a graph of dolphin size to dolphin weight, and then assigning the map to ostriches.

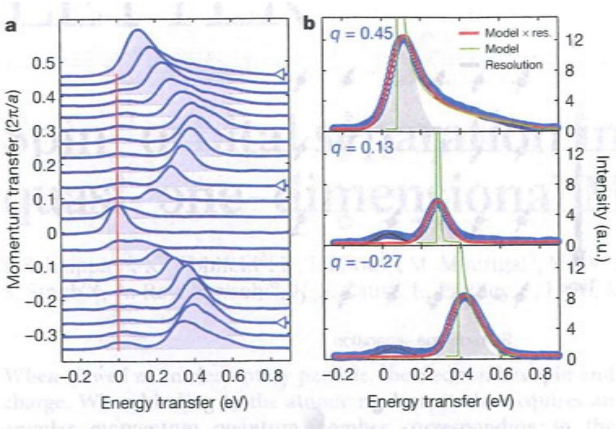
Yes, the redder lines high on the graph have to be explained by quantization, but as I have shown in my nuclear papers, they can better be explained by nuclear structure than by electron orbitals. The nucleus channels real charge photons, and so we get quantized mapping like this. But we don't even need to get into that, because, as you can see, the orbiton-spinon assignments here don't make any sense regardless. They just put the orbitons high, because we see orbital quantization high. And they put the spinons low, because we see a wave low. But since the wave is created by photon momentum versus photon energy, the wave should be assigned to the photon field. Why are they assigning it to spinons? Likewise with the quantization high. This indicates quantization in the photon field, which then *may* indicate quantization in anything that interacts with the photon field (like electrons or the nucleus). But it doesn't indicate orbitons and spinons at all.

These authors are simply *assuming* that the quantized electron is causing the photon field to be quantized. I have shown in previous papers that is upside down. It is charge that drives and spins electrons, not electrons that create charge. It is the recycled charge field that is causing the nuclear field to be quantized, including—in some cases—the electron. So what this graph is actually telling us is that the charge field coming out of the nucleus is quantized, giving us the redder lines high. And it is telling us that the X-rays sent in by the authors interact with the existing charge field photons to create this wavelength we (most clearly) see low on the graph. The wavelength low is not a spinon, and the quantization high is not an orbiton. We will see very clear evidence of this below.

Continuing to study fig. 1c, we get:

Zooming into the magnetic part of figure 1c, between 0 and 0.8eV in energy transfer, reveals strongly dispersing spin excitations.

No it reveals some sort of wave created by the incoming photons and the existing field. The natural place to look for the creation of this wave is in the meeting of photon wavelengths. They tell us that the periodicity here is π, but we can see for ourselves it is .4. They completely ignore that main wave from -.4 to 0 to .4. But rather than study the actual wave we see, they turn it on its side in fig. 3a and start doing measurements on its amplitude or height.

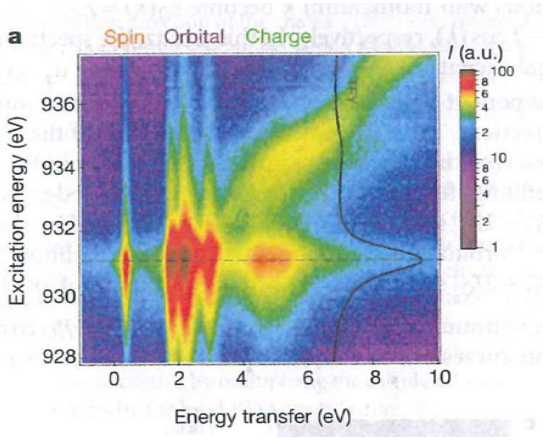


That is very odd. If they think the height is important, they should tell us why. They tell us these are "strongly dispersing spin excitations," but give no evidence or argument. Even if these bumps indicate spin excitations (and I don't think they do), they would indicate photon spins. This chart is a photon chart, remember. There is no theory in this letter that I could find indicating how photon spins become virtual electron spins, which become spinons.

To see how they are force-fitting the data to their spinon theory, we have to study the subtext to these last two graphs, where they tell us that part **b** is being fit to the two and four-spinon dynamical structure factor. The footnote there is to the Caux-Hagemans solutions, which created some sloppy spinon math out of nothing, just so that future experimenters would have something to fit. I won't even need to get into that, since you will see the push here without it. The thing to ask them is why they chose the three humps at .45, .13, and -.27. As we see, it is simply because those humps fit the Caux-Hagemans dynamical structure factors. But those three humps don't recommend themselves for any other reason. Logically, you should either take the humps at -.4, 0, and .4; or you should take the maximum and minimum humps at -.3, -.05, and .45; or, if you really want the humps at -.27 and .45, you should take the hump halfway between, at .1. As it is, the choice is completely arbitrary.

So, to sum up the pushes in figure 3, we have 1) the graph turned on its side for no given or apparent reason; 2) a study of hump position and height, for no given or apparent reason; and 3) three humps chosen for no given or apparent reason, beyond the fact that they can be made to fit some previous spinon solutions.

Not accidentally, we also have all the real data ignored. We do have some interesting data, but it is not addressed. What we should be looking at is the .4 wavelength of the large wave in figure 1c. We should also be looking at its amplitude, which they admit is about .8. And we should be looking at its average energy, which is again about .4. We should also be looking at the band that they call xz, yz, which has arms that are following the same wave pattern as the wave down below.



They purposely misread figure **2a** in a similar way. These are all indications of charge field quantization, so why assign the left one to spin, the middle three to orbit, and the right to charge? Why should charge be higher on the energy transfer arm than orbit? Doesn't this seem arbitrary to you? But it is more than arbitrary, it is false. They are trying to put labels on the quantized bands at .4 and 4.5 to hide that data. You see, according to current theory, Sr_2CuO_3 can only create the three quantized orbitals. The other large red bands and spots cannot be explained with orbitals. That is why they have to assign them to spin and charge. But notice that in figure **1c**, they tell you that charge is "at least an order of magnitude lower" than orbital quantization. Then in figure **2a**, we find that charge is about

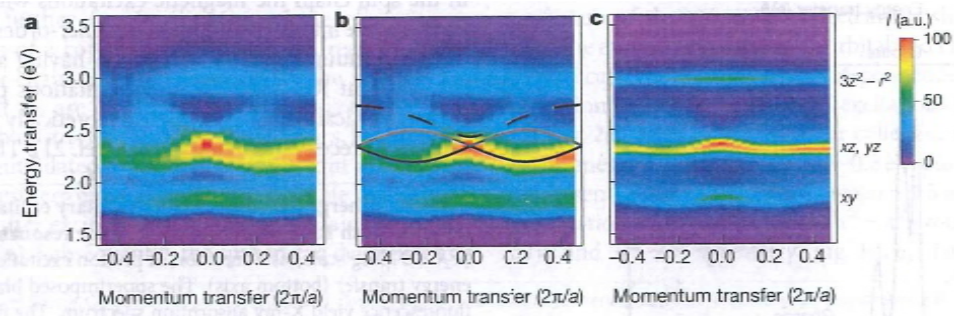
double the average orbital number. They should have an explanation for that, and all they have is a footnote to Sala et al.'s paper, which is also on *d-d* excitations. That paper does not explain the anomalous data here; and even if it did, we would expect more clarity in this letter. You use external footnotes for external references, not to explain central parts of your own data. This announcement should have some linear explanation of how data confirms theory, and they don't have that.

Just ask yourself how the middle three maxima can be orbital and the right maximum can be charge. Aren't the orbitals caused by *charge* quantization? To say it another way, orbital and charge are not separable fields. The orbit is caused by charge and is a straight function of it in the field. The orbit is just quantized charge. Each orbit is supposed to be a level of charge in the field. How can the cause and effect get separated on this graph? We can separate charge and orbital in our quantum numbers if we like (although I don't think that makes any sense, either), but if charge is causing the orbitals, how can the field or the graph separate them as a matter of photon energy or momentum? It is strictly illogical. It would be like finding separate maxima for spin and magnetic, although spin causes magnetic. They seem to understand that spin causes magnetic, and I don't see them separating the two in this letter. But they are trying to separate charge and orbital in the graph, and they can't do that for the same reason.

Finally, they move on from spinons to orbitons. They start this section by saying,

Having unambiguously identified the fractionalized spinon excitations in the low-energy sector, we now concentrate on the orbital excitations in figure 4.

Unambiguously? [Turn on laugh track].



In all three parts of figure 4 above, you can see the wave match to the low-energy sector in figure **1c**, as I pointed out above. It is most obvious in xz, yz (the central band), where the .4 wavelength is striking. But the lower band xy also has the same wavelength, with a smaller amplitude. Since this would tend to refute their division of these upper and lower-energy sector bands into spin and orbitals (as in figure **1c**), they have to misdirect you from noticing it. They say that because these three bands have "a novel, distinct dispersion," it "proves the orbital excitations are of a collective nature." In other words, it proves they are orbitals where the lower band is spin. But I have shown these graphs prove just the opposite. Since the lower band has the same wavelength as the upper bands, all of them must be "of a collective nature." Which is to say they are all caused by the same thing, which is the meeting of photon energy with photon momentum, which is the meeting of introduced photons with charge photons.

Since this is so obvious, they have to misdirect even more. They say,

The xz excitation has the largest dispersion, of ~0.2eV, and has a spectrum containing two peculiar components: a lower branch dispersing with periodicity π and, above that, an incoherent spectrum with a double oval shape.

How's that? It simply isn't true. The wavelength is .4, and the upper arms are neither "incoherent" nor "double oval." They have a clear wavelength pattern, of periodicity .4, just like the low-energy sector wave in figure **1c**. They even misdirect with the dashed line in figure **4b**. Look how they purposefully dash-in the wave much larger than it actually is. This is criminal! They should be tried in a physics court for purposeful misrepresentation.

How do they get away with this? Am I the only one who actually reads these papers?

Again, we have lots of good data here, but it is either being ignored or buried. The most important data is those two anomalous maxima in figure **2a**, but we also have the wavelengths created here, and we have the "excitation energy" of 931 eV. Although each of these findings is very suggestive, our team passes them by without comment. In my next paper we will look at the nuclear makeup of Sr_2CuO_3. That is the only way we will be able to make sense of this new data.