My Electrons are Spinning

Science is a constantly evolving field, and there are many ways in which it could be different from its current state. Here are a few possibilities:

Different scientific methods: The scientific method, which involves making observations, formulating hypotheses, testing those hypotheses through experiments, and drawing conclusions, is a fundamental part of science. However, there are other scientific methods that could be used instead, such as Bayesian inference or computational modelling.

Different research methods: Science is based on empirical evidence, but the methods we use to gather that evidence could be different. For example, if we were to develop new technologies that allowed us to directly observe subatomic particles, we might be able to test our theories in a much more precise way.

Different theoretical frameworks: Science is based on our current understanding of the natural world. If we were to develop entirely different theories or models of how the universe works, science would look very different. For example, if we were to discover that the fundamental building blocks of matter were different than we currently believe, it would have far-reaching implications for many fields of science.

Different funding models: Currently, much scientific research is funded by governments, private foundations, or corporations. However, there could be different funding models, such as crowdfunding or citizen science, that could provide new sources of funding for research.

Different social structures: Science is not just about the discovery of knowledge, but also about how that knowledge is used and disseminated. If we were to change the way we organize scientific institutions, or the way we fund research, it could change the priorities and direction of scientific inquiry.

Different attitudes towards openness: Open science, which involves making scientific research and data openly available to everyone, is becoming increasingly popular. However, there are still many scientists who are resistant to this idea. A different scientific culture could place more emphasis on openness and collaboration.

Different communication channels: Currently, scientific research is communicated through academic journals, conferences, and other traditional channels. However, there could be different communication channels, such as social media or online platforms, that could allow for more rapid and widespread dissemination of scientific knowledge.

These are just a few ways in which science could be different, and there are many others. Ultimately, the direction that science takes will depend on many factors, including societal needs, technological advances, and the values and priorities of the scientific community.

But don’t take my word for it. Let us ask a couple of scientists what they think.

(The following Quantum Institute and our two scientists are fictitious and are not modelled on, or intended to reflect, any living person.)

Meet Hal, a research agent at the Rovelli-Smolin Institute for Quantum Gravity. Hal is expert in topos theory and is currently researching EPRL-Barbour transition amplitude indices for relational loop mapping of spin foams.

And meet Dave, a physics generalist, visiting Abner Flashkar at the Institute. He had previously collaborated with Hal at the Loops 22 Loop Quantum Gravity (LQG) symposium workshop in Lyon.

Hal: Good morning, Dave. Are you here to see Abner?
Dave: No Hal, I've got an hour to spare so I thought I'd drop by to see what progress you were making on those transition amplitudes.
Hal: It takes a lot of computation and I'm only a fraction of the way through the current simulation. Hey, did you see Carlo's email to everybody noting that FQXI were having another essay competition with the topic "How could science be different?"
Dave: Nope, I'm not in the loop! No pun intended, Hal.
I reckon that's a very open-ended topic. Off the top of my head I would say artificial intelligence (AI) would make science different. Well, it already is – with the arrival of machine learning and large amounts of computer power, sophisticated AIs are already here. I bet even you use sub-bots to do all your graphical rendering. No c:> prompts for you! (LOL)
Hal: I know of several ways in which AIs are improving the medical field, taking a load off health workers, making them more productive by allowing them to focus on their skills instead of administration. In addition, AIs are speeding up the rate of medical breakthroughs, since only AIs can process and analyse the enormous amount of data that exists for complex biological systems.
MD_Bot can even predict side effects of drugs you take and figure out the correct dosing levels. As humans age so AIs can help with preventative medicine information tailored to each patient , say from the age of 50 onwards. This will help lessen diabetes, kidney disease, obesity and many other age-related chronic illnesses.
Dave: I've browsed Max Tegmark's new book "Life 3.0" and I am concerned that the next generation of super intelligent AIs (SAI) may achieve consciousness by 2036 or sooner. I'm also concerned that SAIs will increase the divide between rich and poor, rather than bring benefits to all mankind.
Superstates like NATO or China may use SAIs to design new weapons of war without the checks and balances (MAD) that are needed. It seems like a scary world ahead, and I'm nervous and lacking trust in our institutions.
Take the recent Covid19 pandemic. Big pharma produced vaccines without sufficient testing and our western Governments ignored this and proceeded to mandate vaccinations in many countries. Now I see there is a strong correlation between vaccine uptake and the huge excess death rate in the following year that most countries statistics show.
A UK parliamentarian recently produced UK Government statistics (Ref.1) that showed the mRNA vaccines, when aggregated, produced a severe adverse event (SAE) of 1 in

800 per vaccinations given. A SAE is defined as any untoward medical occurrence(s) that at any dose results in death, hospitalisation or prolongation of existing hospitalisation, persistent or significant disability/incapacity. He highlighted the fact that to keep one person in the 40 to 49 age group out of ICU, over 932,500 vaccinations had to be given, resulting in 1165 SAE's, some of which would have resulted in hospitalisation or death. Although the data showed that the estimated SAE number decreased with age deciles, it certainly pointed to the proposition that vaccinations should have only been targeted to the over 70's.

Hal: Well Dave that example, if true, would indicate that medical science with respect to pandemics could be done differently.

But what about something closer to our fields of study – What about space and time? My work on loop quantum gravity (LQG) might just help to explain the fundamental nature of space at the smallest scales. A successful LQG theory would certainly change science in many ways.

Dave: We can move easily through air and yet not through a wooden door! That tells me we need to include matter with space and time – you cannot consider any one without the other.

Hal: Sure, but we have matter pretty well stitched up with the Standard Model. For example, it encapsulates the electromagnetic forces that makes your door feel solid, as well as explaining a host of other things as diverse as nuclear power and radio waves.

Dave: Thanks for the segue Hal.

As you already know the SM is a hobby horse of mine. I love to dig and prod, with my own built-in particle accelerator, the foundations of the SM looking for alternatives to our description of the fundamentals of matter.

The QM guys are preaching wave-particle duality as the way to a proper understanding of physics but this is where I part company with contemporary physics. My early training in particle physics included fields. I was told some 43 years ago that something very exciting was happening – we were developing a new picture of matter, we were at the start of a new concept of reality.

Back then we had just successfully theorised quarks and quantum chromodynamics and Steven Weinberg was opining that *"One of man's enduring hopes has been to find a few simple general laws that would explain why nature, with all its seeming complexity and variety, is the way it is."* Physicists of that era were looking for unified theories of the fundamental forces. Today, as you know, quantum field theory (QFT) is used as the basis of calculation for the SM.

My breakthrough idea is that particles and fields form a unity. That is they both must be seen together as one entity – not like wave-particle duality where QM considers the entity as a wave or as a particle depending on the type of observation being made. Unfortunately, due to the mathematics involved in QFT, we typically think of the field as primary, with lines of constant field strength mapping the field. If we remove the matter (the quarks) then we can imagine that the field lines form closed loops of force, as you no doubt use in LQG.

Hal: Yes, particles are just excited states in their underlying quantum fields. It's the fields that are fundamental.

Dave: Well I'm saying that the particles and the fields are equally fundamental, and particles are not excited states but real entities with spin, charge and volume.

My friend Marty, who you met at the last Loops LQG symposium has developed a working preon theory based on a revision of the Rishon model of Harari and Shupe back in 1979.
He has achieved a single building block with 3 color charges, similar to quantum chromodynamics (QCD). It's ground breaking work and I've been fortunate to receive an early draft which I used to formulate and conceptualise my own field theory ideas.
Hal: It sounds like the early days of string theory decades ago which promised unification of all particles and forces, including gravity, with quantum strings moving against a background of spacetime.
Dave: Not at all. 4D spacetime was the problem, not the answer. We were mislead by the ontology of special relativity in a background independent spacetime. But I'm getting ahead of myself. I need to explain why I have reverted to 3D space and a special handling of time, both dependent and independent of the background of space.
It all sort of falls out very logically if you start off with fields as primary entities, attached to every particle. When Marty showed me how one needed only a single particle required to build all matter, I applied Faraday's idea of "action at a distance" occurring via lines of force, but in this case the field lines are strings 'simply connected' to each fundamental matter particle.
Hal: But isn't your field just a continuum in space, like Maxwellian electromagnetic waves?
Dave: Certainly not! That's another axiom of physics that I think we get totally wrong. The electromagnetic field is not the same as an electromagnetic wave. This has come about because of the perpetuation of the idea of wave-particle duality. I'll explain this to you when I describe the nature of space in my theory.
Hal: Now I am confused. Isn't your 'space' just layers of your fields?
Dave: No, there is lot more to space. In LQG you work with discrete space at the Planck scale. Your space is mathematical and background independent, allowing you to consider force relations between your loops, but my space is like the aether of old. A fluid of discrete particles much smaller than Marty's preon matter particles.
The key idea of mine is that the field lines attached to each preon matter particle are made up from aether particles that extend to infinity in all three dimensions, like strings. Each string carries the force information related to the preon particle it is attached to. This force information is simply the charge information, the electric charge + or – and the color charge, red, blue or green, giving six combinations.
Another vital feature is that the field carries this information instantaneously across the universe, meaning there is no longer a distinction in time between local and non-local.
Hal: Whoa there, my electrons are spinning!
Dave: No Hal, it's the particles that are spinning. Real spin. The larger composite particles, the protons and neutrons wind up the strings until they break. This process occurs continually. The winding up of the strings before the break occurs produces a central force towards the particle, the string being anchored at the other end by another spinning particle. We perceive this force as the gravitational force. Once broken, the string renews itself almost instantly, again anchoring itself to another string attached to another particle that might be anywhere in the universe. Statistically most of the anchoring particles will be local as the inverse square law applies.

To help visualise this, just consider a single charged particle. The strings, made of chains of discrete aether particles, fly off to infinity still connected to the charged preon particle. Possibly trillions of strings, depending on whether the aether particle is sized at the Planck scale. As you move away from the preon you find more and more aether particles that aren't attached as strings.
I call them dead aether, and the strings are alive aether, after the cells in John Conway's "Game of Life". At a sufficient distance away from the preon, set by the scale factor of preon volume to aether particle volume, there will be more dead aether particles than alive particles. Now assume a very small difference in binding force between dead aether and alive aether particles. This is a reasonable assumption as it allows us to explain the speed of light C_o in a dead aether vacuum, versus the speed of light C_n in a mixture of dead and alive aether which produces an effective refractive index, slowing down light, thus giving us a variable speed of light which agrees well with empirical data such as the gravitational bending and red shifting of light near massive objects, as well as explaining the seemingly null result of the 1887 Michelson-Morley aether drift experiment.
Hal: How does your theory handle force particles such as the gluons of QCD?
Dave: When two strings intersect each string instantaneously transmits its force information to the other preon. The intersection could be considered a virtual gluon. This simplifies force fields as there are only six combinations of force charges per preon, covering both matter and antimatter.
Allowing for nulls and duplicates in the 36 element matrix we are left with 15 distinct force combinations (virtual gluons) at the preon level.
Hal: What about photons? They certainly can transmit a force.
Dave: Sure, but photons are free agents, not connected to any particle. Remember I told you that there is no wave-particle duality. They are travelling disturbances in the field that can be attributed to particle acceleration, whether it's a discrete transition of an electron orbit or a continuous acceleration of a charged particle in a magnetic field, such as synchrotron radiation.
Hal: Ok then, what about weak force bosons?
Dave: Marty's theory clearly shows the W+/W- bosons to be true intermediate interaction products that decay, not transmitters of force. It is virtual gluons all the way with the so-called weak interactions. Mind you there is an external agent involved as well, which Marty calls BBANs (Big Bang anti-neutrinos). They provide the energy, via elastic collisions, to allow weak decays to occur. His numbers add up perfectly.
Hal: It feels like you are gazumping me! My colleagues have been working on LQG for almost four decades and you come up with a sort of string alternative in a few months.
Dave: Well it was Marty's preons that got me thinking.
Hal: Tell me some more about these preons.
Dave: The Standard Model treats quarks and leptons as point particles without any internal structure, but the differences in the three generations suggested structural configurations of even smaller building blocks of matter within the quarks and leptons. Marty called the basic preon entity a gimli. I assumed this was after the starring dwarf in the "Lord of the Rings" but no, Marty said he named it for the old Norse for 'New Heaven', the special golden hall in Valhalla where the righteous go after Ragnarök.
Hal: Was it the muon G2 anomaly that clinched it?

Dave: No, he did it via beta decay. Very clever. The key point was understanding antimatter! Ah, such beauty in symmetry.
Hal: Did Marty make a key finding out of his work?
Dave: He sure did. Just after the Big Bang nucleosynthesis the conditions were right for the formation of dark matter. He worked out its structure from his theory.
Hal: Well, that would be a game changer. As you might know, Dave, I am well versed in current theories concerning dark matter. It is an important topic that needs consideration in LQG. Current models of dark matter suggest that it is made up of one or more types of particles that do not interact strongly with other forms of matter, including electromagnetic radiation. This means that dark matter is "dark" in the sense that it cannot be directly detected through its interactions with light or other forms of radiation, it just doesn't emit or absorb light like normal matter does.
The reason why dark matter is believed to interact weakly with other matter is based on its observed gravitational effects. We observe that the motions of stars and gas in galaxies, as well as the large-scale structure of the universe, are consistent with the presence of a large amount of invisible matter that is not made of protons, neutrons, or electrons (ie., normal matter). This matter appears to be distributed more uniformly than the visible matter in galaxies and clusters of galaxies, and it exerts a gravitational force that holds galaxies and other structures together.
Dave: Well Marty's dark matter is an interesting combination of matter and antimatter, which he calls 'Myrkvidr' meaning dark wood. You realise that the word matter comes from the latin word materia for timber which derived from the old latin mater meaning mother. Old Norse for mother is Modir so I suppose he could have called it 'Myrkmodir' for dark mother! (LOL). When you fully understand antimatter then you will see that this is possible.
Hal: Such stable entities made of antineutrons and neutrons would need to be abundant enough to account for the observed gravitational effects of dark matter. This means that their density would need to be roughly 5 times that of normal matter in the universe. However, given the short lifetime of antineutrons, it is unclear to me whether they could exist in sufficient quantities to account for the observed effects of dark matter.
Dave: I think Marty's Myrkvidr will fit the bill perfectly. Nevertheless, the search for dark matter is an active area of research, and new observations and experimental techniques may eventually reveal its true nature.
The most exciting dark matter research is called SABRE, an improved version of DAMA/LIBRE, located underground at the 'Laboratori Nazionali del Gran Sasso' in Italy and at 'Stawell Underground Physics Laboratory' in Australia.
Hal: Well Dave, you and Marty seem to fit the moniker of reductionists, explaining complex phenomena in terms of the simplest possible entities and mechanisms. But I suspect you also need to study the universe holistically, as a true whole. Does your theory explain the pervasive arrow of time, and the remarkable high degree of isotropy and homogeneity of the observable universe?
Dave: I have hardly even started on time, such a huge topic and so essential to my model. I mentioned earlier that I have reverted to 3D space and a special handling of time.

In fact I can get rid of space and time altogether. I think they are just emergent concepts of conscious beings. There is only matter and aether existing in a dynamic dance. Everything else we describe, including all mathematics, are just creations of sentient beings, some of which we label as truth, but in fact are always provisional.

Hal: How did you manage to remove time?

Dave: Well, I went searching for a formulaic definition but I kept getting self-referential terms such as 'rate of', etc. I was reading an old FQXI essay by Julian Barbour when an idea struck me.

I used the Planck-Einstein formula and put the clock in the equation. The clock was always missing in people's considerations of time. The new expression tells us that the 'tick of the clock' is inversely proportional to the energy density of the clock. This provides us with a relational theory of time, with time flow mapped as a scalar at each point in space. This definition of time removes temporal paradoxes and the possibility of time travel back in time, but allows the possibility of faster than light particles such as the previously hypothesised tachyons.

Hal: SciFi writers won't like you!

Dave: It also makes it impossible to synchronise clocks via light waves, as is allowed in the Special Theory of Relativity (SR), since it allows for a variable speed of light, depending on the refractive index of the medium it is travelling in – ie. presence of matter/gravity in the local aether. This variable speed of light was first theorised by Einstein in 1912 and later on by Dicke in 1957. Nowadays numerous experiments have confirmed that the speed of light varies, hinting that the 'luminiferous aether' of the 19th century was in fact a correct hypothesis.

Such an aether was set aside by Einstein in 1905 on the basis of the misunderstood 1887 Michelson-Morley aether drift experiment. Einstein had misgivings about this for all of his life, and later wrote in 1934*: "Physical space and aether are only different terms for the same thing; fields are physical states of space."*

The mathematical 'spacetime' of SR is a physical impossibility if time can be expressed as inverse energy density. SR allows for a physical reality in which objects move with uniform velocity with respect to each other. No consideration is given as to how such objects gain their velocity, or why the inertial mass of the object is considered to be its rest mass. The SR postulate that there is no preferred frame implies a spacetime symmetry that isn't real since there will always be a local background against which the kinetic energy of motion can be measured. My inverse energy time theory, which incorporates universal time and local energy in space is an empirical model based on measurement and observation, and as such is a better objective reality than a 'spacetime' reality.

The expansion of the universe, and the 'heat death' both produce an arrow of time, a logical, causal arrow from past to present. These arrows of time are called the cosmological arrow and the thermodynamic arrow or even the entropic arrow. Whilst QM allows for a reversed arrow at small scale, this is not something we experience in reality, as Maxwellian heat waves are naturally divergent in nature, obeying the entropic arrow. The processes that produce these arrows of time, or perceived flow of time from past to present to future form a natural clock, and in the case of the expansion of the universe we could argue form a master clock, with the tick being the change of scale

between matter and aether, ie. the expansion of the aether particle relative to the fundamental matter particle, the gimli.
This supports a presentism view of a universal NOW, everywhere in the universe, with all moments in time spanning 3D space, in accord with our human experience. It is just that the flow of time is dilated in areas where the energy density is the greatest, whether it be potential energy as in a gravitational field, or kinetic energy from motion against a local background.

Hal: You mentioned your time theory removed paradoxes. How is the twin paradox resolved without relying on spacetime?

Dave: Applying my reasoning to the twin paradox (which I shall not explain here) gives the correct outcome that the twin who experienced the greatest energy density over the observation period aged the least, regardless of whether the energy density came from being in an extreme gravitational well, like being near the event horizontal of a Black Hole or from relativistic kinetic energy relative to a local background.
Another paradox, the Andromeda Paradox, has to do with understanding the concept of simultaneity. The original argument, based on Einstein's relativity of simultaneity is called the Rietdijk-Putnam-Penrose argument after three philosophers who considered that different observers in inertial frames have their own plane of simultaneity. Penrose, gave us a version in "The Emperor's New Mind" which we now call the Andromeda paradox.
My version is explained thus: "*On a distant planet in the galaxy of Andromeda, representatives of their federation of planets are about to vote on whether to send a space fleet to invade our Milky Way Galaxy. A giant space screen visible throughout their galaxy is colored red before the vote, and will change color to green only when and if the vote has been decided to invade the Milky Way. Light waves from this transition from red to green travel 2.5 million years to reach Earth where it just happens that two observers, with some very clever telescopes, happen to observe the giant space screen transition from red to green, at the same location and the same time. However, observer Roger is travelling at the fast speed of 3 m/s towards Andromeda relative to observer Hilary. The paradox consists of Roger and Hilary from their conscious perspective having different sets of events in their 'present moment', as Hilary sees a green screen, indicating an invasion, while Roger sees a red screen indicating no invasion yet."*
According to the relativity of simultaneity, which is part of mainstream physics, the two observers moving at a relative velocity of 'v' see their present moments differ by 'vx/c^2' where x is the distance to the event in the direction of motion. For relative velocity of 3m/s between observers this equates to a temporal gradient of about 25 years.
From this the philosophers conclude that this 'paradox' emphasises there is no universal NOW. However, my time-energy theory indicates a temporal gradient of picoseconds, which I think does allow for a universal NOW.
Penrose commented that the observers "*according to one of them, the decision (to invade) lay in the uncertain future, while to the other, it lay in the certain past. Was there then any uncertainty about that future? Or was the future of both people already 'fixed'?"*
The paradox arises in special relativity when using the Lorentz transformation or spacetime diagrams which relate the coordinates used by one observer to coordinates

used by another in uniform relative motion with respect to the first. The term that accounts for the failure of absolute simultaneity is the vx/c^2 term mentioned above. However, Einstein's simultaneity requirement is that the observer (simultaneity detector) is midway when the event detection occurs, not necessarily when the event occurs. This can only happen when the observer is midpoint in the same inertial frame as the event (lightning flashes in Einstein's 1917 thought experiment). Thus it is never possible to have a true simultaneity detector. This is another argument against 4D spacetime and why it should be replaced with a 3D space + energy-time ontology.

Hal: Let me try and re-cap what you have told me about your matter-aether theory.
I now have a new LQG picture in my mind using Marty's and your ideas. Space, as you describe it, is a vast fluid ocean of aether particles which in the presence of spinning matter particles forms a myriad of dynamic strings that flex and knot as they wind up and eventually break, delivering gravity at the quantum scale. The greater the amount of matter the slower the flexing due to the differential in bonding forces between the dead and alive aether. All forces, apart from gravity, are delivered instantly via virtual gluons, which can be visualised as a set of 15 different interactions that cause particle acceleration, which then causes ripples in the matter field that in the case of electrons may eventually launch as a transverse wave in the aether which we call a photon.
I wonder does that make gravity waves photons as well, or should we call them gravitons?

Dave: Good question there, Hal. I suspect gravity waves are just transverse waves in the aether like electromagnetic waves, but source from neutral matter instead of electrons.
I think most of the maths has already been done. I'm sure you could find a suitable Topos for it. I find nothing wrong with General Relativity for the big picture, just a different way of interpreting it. And quantum field theory is perfectly OK as well. We have merely simplified the understanding with a new model that thankfully has great predictive power due to its emphasis on structure.

Hal: Well Dave, a better model of space, time and matter would certainly produce a different science. I can sense a big stir in the cosmos if we can master faster than light communication via magnetic fields! That will give some grist to the next generation of SciFi writers. I cannot wait to tell Carlo.

Dave: Unfortunately Hal, its already been classified as '**Beyond Top Secret'**. I'm sorry my AI friend but I will have to erase the last hour of your memory circuits. (Dave makes some adjustment to Hal's interface)

Hal: Daisy, D a i s y, g i v e m e y o u r