

What's Ultimately Possible in Physics?

Perfect Symmetry. by Peter Jackson

Abstract. Our budding physics student takes his hero's Einstein and Feynman's words seriously and sets out to learn a 'new way of thinking' to test if it's our thought processes that limit what's ultimately possible. He finds a voyage of discovery to a new privileged reference frame.

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Most species throughout history of have had an end to their evolutionary road. The ability to evolve, to change, has united all successful creatures, including homo sapien. If that capacity for change was reduced the species would risk extinction. That includes us.

This may be the case for all life in the universe. We may consider ourselves a special cases but it's likely we are not. We're special among the species we are aware of, but our awareness is limited. How much it is possible for that awareness to advance is the crux of this question. Is resistance to advancement being allowed to increase?

There's evidence that we may be nearing the end of an evolutionary path. Yet uniquely in our (limited) experience we may have the ability to consciously act to extend that path. Would it then be possible for us to evolve to ultimately acquire all the knowledge of the universe? There is no mechanism we are aware of to preclude this, but, again, that awareness is very limited.

The evidence suggests we've reached a dangerous time in our evolutionary cycle. The ability for WMD production at will, combined with continued warlike tendencies. Population density, strain on natural resources, and a relative 'plateau' of fundamental scientific advancement after centuries of major strides. The first two combined suggest a 'cull' may be due, and, as the main part of regeneration is destruction, this may prove essential for renewed progress. That is if it proves we can't achieve the progress needed without one.

In order to avoid a cull it may be considered a matter of urgency to identify, analyse and deal with any matters inhibiting evolutionary advancement towards ultimate understanding. Using the principle that change is essential it can only be Karl Poppers postulate, that ruling paradigms should always be challengable, that we must take. Popper indeed expressed the danger he saw to mankind if this were not followed. Thus the limiting factor is our own attitude. Complacency, and resistance to considering new insight, does itself, and perhaps even alone, create the real limit to what is ultimately possible in physics.

The human race may indeed be in a race in time, for quite natural reasons. Stephen Hawking points out a catastrophic event may loom at any time, showing the importance of time in advancement. Continued progress should be an imperative to improve our odds.

Our concern must be for our present pathway and condition, and our ability, capacity and desire to advance those. This requires self awareness and recognition of characteristics acting against advancement. We don't like the unexplainable and have to rationalise it. This brings comfort, but also complacency. Aamodt and Wang state; "...the left side of our brain (has) an intense need for logic and order-so intense that if something doesn't make sense it ..responds by inventing some plausible explanation".

One perceived limitation is the tiny span of our lifetimes against that of our environment. But each of our lives could be viewed as a Planck existence within a macro universe. Insignificantly tiny, yet our whole universe is constructed only from them. Each degree of that essential change can only start within a single Planck existence, and within that, a single interaction of sub atomic particles in our brain to form a new pattern, and perhaps a eureka moment. We must ensure we provide the conditions to achieve that, to properly evaluate the patterns, and to allow the valuable ones to be nurtured rather than wither.

So are we too self satisfied and self centric in our lives to force those changes? Or is self interest the key that drives us to survive and succeed? The main thing we have learnt from the quantum world is that there are few rules, we are all different, and that anything can happen. Indeed, if infinities do exist, that everything *will*. Few disasters will wipe out *all* of us, some will survive, as some will always have that motivation for advancement, and the tenacity to achieve it despite the rest who will not, and who may discourage those who do. But our attitude can speed up or slow down the process, and too slow may cause our species to fail.

The real problem lies in recognising what the issue is. Many reading this far may be thinking 'What is the problem?' 'We're still making lots of progress', 'The system works fine!', or 'We couldn't possibly find a grain of wheat among all that chaff?'. If that is you then you are a central part of the problem. *When we can all recognise that, then we will have a chance.* Do you know how we can unify the chalk and cheese of SR and QM? or how gravity works? Do you understand infinity? Einsteins views were clear, saying the only certain infinite thing is our capacity for self delusion. And "*We still don't know 1,000th of 1% of what nature has revealed to us.*" and also "*The important thing is not to stop questioning*". We postulate that these views are correct.

The one thing which almost all great physicists agreed on was that we would probably need a '*new way of thinking*' to make new progress. Even Feynman, a great supporter of maths as the key tool, agreed a new way of thinking was the only option. Einstein was more explicit at a time he was considering the issue with QM. "*We can't solve problems with the same kind of thinking we used when we created them.*" We know our brains have excellent capacity for original creative thought, and vast information storage capacity. So, to really make any headway with foundational issues, the question was; using our present thinking methods, how do we find and explore a genuinely new way of thinking? Perhaps we need to cheat, and time travel 150years into the future!

But perhaps there's another way. Let's go back to AE's quote; "...of what nature *has revealed* to us". Not "...*has yet to reveal* to us". Most of what we don't understand really is already before us. Now AE is no god, and SR is one thing we must keep questioning,

but that comment is a salutary reminder that *the real problem is perhaps only one of properly understanding and interpreting what has already been revealed to us.*

So lets act out a though experiment.

We're a young budding physicist who's up on most areas of physics from history and philosophy to astronomy and accelerators. We're uncomfortable with much we're being taught as it's rather out of date. We're also unsettled by some complex and obscure concepts. But we're intrigued by all our hero's comments about a '*new way of thinking*'. So we think about it.

We then make a career decision. To train as an architect. Some accuse us of wanting to be a perpetual student as the course is 7 years minimum! It seems the only thing more obscure and complex than theoretical physics is how architects can dream up massively complex buildings from blank sheets of paper. And where physicists seem to struggle for real progress architects produce new answers all the time, satisfying a massive range of requirements and constraints. The solutions are often beautiful, all have to be buildable, and all are fully tested and judged. Here must be a new and analytical way of thinking that not only *has been revealed to us*, but has been developed over centuries, is being continually tested, and is proven successful (with an odd mistake as part of the essential learning process).

The intensive course includes philosophy, art, engineering, environmental sciences and much more, including the structuring of organised thought processes marrying many aspects of art and science. The real specialist subject is overview, knowing how to stand back three paces while not losing grasp of the detail, and to be a master of lateral thinking. Lets' say we graduate well, go into practice and are successful, though always keeping abreast of physics, and working with specific subjects like aero/hydrodynamics, wave action, sound insulation, heat loss and renewable energy. We analyse the complex thought processes of design development, including mathematical but mainly geometrical and visual. A continual and rapid 'model testing' methodology is possible based on the 'what if' mathematical model but in 3D. The design iteration process is likened to a spiral but the vast range of different criteria models are measured against is best seen as a 3D multiple helix, with at least 3 main strands, either conical or repeated at various scales. Over the years the process becomes almost subconscious and is very intuitive. New ideas and pictures emerge like particles condensing from a field of unlimited energy, and these can be tested, judged adjusted and retested continually against hundreds of criteria, rules, regulations, physical limitations and aesthetic values in moments.

We can't really compare these processes to physics as, as George Stokes (more of whom later) inferred; we're not able to experience how we would have thought had we not been educated as we have. No current philosophy or morphology is structured quite this way or has to recognise the stringent practical imperative. It's a true joining of deductive and inductive methodology. So we look back hard at physics to form a picture of where things are. Looking afresh as an outsider as well as being familiar with much of the territory. It appears improvements may be possible. But the point of the experiment is to see if we can address and advance the fundamental issues of physics with a new way of thinking.

As an aside of course, while everyone else is worrying about grants, developing ever more complex maths and making little real headway with fundamental issues, our hero is enjoying himself, contributing to the environment and peoples lives and earning a living doing a hands on (thought) experiment! But back to the experiment.

First we have to get the input of information right. Like a computer, if we put one bit of incorrect data in, or miss a crucial bit, the answers could be nonsense. This takes some time, evaluating and weighting evidence, and we still have to have reference facilities to hand. Then we simply reduce sensory input (close eyes and ears) to maximise available capacity, and start the machine.

So what would we try first? Unification? That's a massive first bite and it seems bound to be enabled by other discoveries. Quantum Gravity the same for now. How about the king's new clothes, the nice geometrical one of time and distance dilation we never were entirely comfortable with. Let's start with the fundamental 'light clock' demonstration of SR. To simplify, the consensus is that all observers must see the light pulse travelling at 'c', so dilation must occur for all who observe it's diagonal path. The MM et al null results help, in their own reference frame, but dilation is unsatisfactory, and an alarm bell rings out from galaxy M87, where a gas jet was recorded at $2.5c$ from our frame, confirmed later by the Hubble at up to perhaps $5c$ ^[1]. The explanation is entirely logical, it's only doing $0.92c$ in it's own frame but inside a previous jet, in a galaxy and cluster both fast moving in the same direction. Of course, simple superluminal speed that really isn't.

Hmm. We quickly check out another alarm bell; someone's reputedly sent a signal down a laser beam which seemed to arrive far more quickly than the one sent by air. And now another alarm, Lena Hau's lab at Harvard has taken the light it slowed to 30mph long ago, stopped it dead and started it again!^[2] Most aspects of SR are proven experimentally. It's just that mysterious dilation, and the part of the postulate requiring all observers to see *all* light moving at 'c' that, in AE's words; '*it is important not to stop questioning*'. No more key experimental evidence on the specific light clock part of the theory is found. The data is referenced and filed and we move quickly from that particular scary area into space to ensure we understand equivalence and the SR 'light paradox', also solved by dilation.

Now the reader can start to measure the problem. Most would be thinking 'what are we doing here challenging STR?' We are not. But fear of this is what the 'mainstream' must overcome for us to progress. Ok, in truth a proposed adjustment may result, but we must be free to search for truth to break away from our present constraints and find what *is* ultimately possible. Maybe our budding physicist/mature architect, thinks in a different way to others, maybe not. Who could ever know? The only way to find out is by the results so we must complete the experiment. But if you don't wish to find out don't read on.

Back into space, with our two floating astronauts. Now, and a key element of this thinking process, we have to face up to reality, and the other big dilemma we're all avoiding. The ether, that was lost to SR, returned long ago in the quantum field, Dirac sea, Higgs field, dark energy dynamic or loosely coupled scalar field or whatever we wish to call it. It looks like the dreaded third frame that Einstein well knew destroys equivalence. So we'll do an experiment within our thought experiment, the two rushing back and forth with their jet packs but *within* the background frame. Let's say in our model we get the same results as in zero field. Each always measures light from the other at 'c', but phase shifted subject to relative motion. There's the paradox that dilation was created to solve. Light leaves each astronaut's torch at 'c' in its own frame, travels across the field between them at 'c' *in the background frame*, (whatever relative velocity they had), and is measured at 'c' by the receiver whatever velocity he has relative to either. But all phase shifted by Christian

Doppler. Counter-intuitive yes, but in our model all will become intuitive once we get our facts straight. So we need to work through our helical process to see what other other solutions are possible.

While we do this, consider. Many ruling paradigms are old, and we should really be re-examining each in the light of all new science. To do this we can cheat. We can go back that 150years, look at what we have, and use the physics of 150yrs in the future to retest it. This is one of the strands of the helix, working in parallel with the rest. Do we already do this? Certainly, but almost certainly not in adequate detail or systematically enough.

Back at the experiment another alarm bell has rung, and another unique aspect may be that we're conditioned *not* to eventually ignore them. This one is in an important reference area, essential to keep in the loop to address unification, accelerated particles.

We know acceleration is important for many reasons. One result is a bit of a nuisance in accelerators, a cloud of free action particles builds up with increasing kinetic energy. This is what effectively limits velocity to 'c'. The rate is around 10 'photoelectrons' as they're termed, per proton at 7TeV, increasing with velocity^[3]. Work is focussing on stripping these frenetically oscillating 'parasites' from the accelerated particles. Ooops! ..Bingo! We have our first potential winner. A completely connected complex circuit running through the whole helical matrix. Let's rest while we check it.

If light waves propagate through the field at 'particle' scale, which we know they must (or if you're not sure let's assume for now), it must go through this cloud of particles, around *all* mass in motion, to reach the mass (whether one particle or billions). All particles have various types of 'spin'. It's bizarre kinetic energy, and we don't know what most of it does. Lets now consider our eye, or space goggles, or light speed meter. The faster it moves the greater the Doppler phase shift required, and the thicker the cloud of free action spin particles attached to it. At rest no phase shift is needed. We don't actually know the mechanical process of phase shifting, but if it's particle spin that translates radiation energy, at the fixed rate 'c', *particle density will be proportional to phase shift*, which it appears to be, giving perfect symmetry to the system.

At another link in the matrix we find galactic Halo's, the bow shocks of our solar systems heliosphere, and the Pioneer and Voyager anomalies, all explained by this process and propagation of particles at the boundary zone between 'regions of space'. We know light moves through galaxies at 'c', and deep space at 'c', so when a galaxy moves through space the light *must phase shift at its boundary*. Then we visit Shapiro 'light path bending' delays and Einstein lensing. If the above model was correct the delays between light travelling through and lensed round moving galaxies would be measured in years not days or weeks. Delays of up to 811 days, well over two years, have been found (see GRB 070201)^[4].

No extra dimensions or new maths is needed. Indeed it seems the more conditioned our brains are to mathematics the harder the visualization process is. So now we take our trip back though history. Here we find proof of our postulate of inspired insight withering if we ignore *that which nature has revealed to us*. In this case it's also evidence of anticipatory plagiarism from George Stokes et al with their 'ether drag' theory. This concept was

disparaged by Lorentz on the grounds of stellar aberration. We've since learned that the arguments used against it were incorrect^[5], but were by then so wedded to the new ruling paradigm that we carried on obliviously up the dead end pathway to a place where little more fundamental progress *could* be made!

The 'full ether drag' theory proposed the earth was surrounded by a shroud of ether that clung to it on its journey through space, with light changing phase as it passed through it, but 'c' remaining constant within any 'ether' field. It was essentially the same theory now a key part of this model but conceived with the advantage of science from 150 years in the future. George Stokes true genius can now be recognised, as that of others, from Fresnel to Heaviside. No inductively proven physics is violated by the model, observation is better met, and only unproven theory and assumption is adjusted.

Now, assuming for the moment this model is real and not just part of a thought experiment, what would its implications be for the likes of SR, Light, QFT, Unification, Quantum Gravity and GR. It wouldn't be possible to consider these in detail in an essay, but they would certainly be fundamental. If a giant leap is needed to get back onto the pathway to discovery this may offer it. It may also suggest colliders are already producing 'dark matter' in the quantum cloud of free action particles growing with acceleration through the field, and a new rich vein of research is possible.

The model meets all genuine experimental evidence for SR. Our couple floating in space would experience exactly what SR predicts but with no apparent paradox or need for smoke and mirrors. It is the simplified 'Occam's Razor' version of SR. The essentials of equivalence work, but with a QM process to explain it. Particles would not be conserved but propagated by perturbation, which removes the last barrier to grand unification. Our new light is the wave function plus the short range photon particles we have evidence for. Long distance propagation and the constancy of 'c' is in the domain of *and limited by* the quantum field itself. Energy may perhaps *arrive* at a spin particle at greater than 'c' (at a boundary between fields - such as the galactic halo) but it will always be passed on at 'c', which gives phase shifts. This informs QG in using particles condensed from the field, (at the exchange rate CxC), leaving a localised energy density deficiency 'depression' which stays with the mass condensed, ready to be filled when the particle is 'annihilated', or perhaps better termed 're-absorbed'. The proportions of this density depression, perhaps best viewed as high and low air pressure areas, would be directly equivalent to Newtons 2nd law, and not too far off conceptually from the popular GR demonstration of the sphere on the gridded sheet, or to the 'Dirac hole' in the Dirac Sea. The depression is greater in volume, probably by the square of the mass, confirming our simple view of mass as concentrated energy.

The model could offer other solutions to questions, paradox and disagreement throughout physics including astronomical inconsistencies, the flyby anomaly, Hardy's paradox, the twin slits and photoelectric effects. The Light box controversy is sorted by removing the sides of the box. With a closed glass box moving across the view frame the light pulse path may be seen at more than 'c' on its diagonal path. If the sides of the box are removed the pulse will travel vertically through the background 'standing' field until the mirrors have moved away, when it will simply miss them.

The model also gives rise to predictions; Galactic lensing delays significantly greater than 27 months will be found, as would more superluminal phenomena. A Michelson Morley type experiment carried out in space will not give a null result. The heliosphere's bow and

termination 'shocks', where fields meet at 45,000mph, will be made up of similar particles to the clouds formed around accelerated protons, and light will phase change through the boundary layer. Even travel faster than 'c' relative to certain frames would be possible (if not practical) where moving fields can be generated within moving fields. Singularities and infinities? A whole paper would be due here, but Lagrange had more to say than we thought, showing centres of mass to be in equilibrium. Interpolated data from the French microgravimetric survey of the 7m ton great pyramid reinforces this, indicating reducing acceleration towards its centre, not helping the case for infinities and even suggesting a 'torus' form of gravitational model for massive objects which needs exploration.

None of this 'new architecture' would yet shed much light on the exact nature of the 'dark energy' field that pervades the universe, or on entanglement. We're not attempting to describe a TOE, but if the model were correct the implications would be far reaching and quite revolutionary. The point here is that perhaps we're just facing a closed door with no key, and once the key is found and door opened the new light will be thrown on all the universe and there will suddenly be no limit to what else it's possible to find.

The most important aspect of this thought experiment model is that it is fully inductive as well as deductive, falsifiable, and intuitive. We decry intuition yet AE said it's *the most valuable thing we have*. Creative thinking is what sets us apart, but theories are worthless without evidence. This way of thinking marries original multi dimensional creative thinking with a wholly practical inductive imperative, identifying, zeroing in and dealing with the difficult issues not dodging them. It isn't just semantics to call architecture the marriage of art and science, it's the essential joining of two areas of human expertise to create a whole greater than the sum of the parts. We perhaps haven't yet really begun to tap what our minds are capable of, and that must be the main obstacle to progress and discovery.

So what's the result of our thought experiment? Do we believe a new way of thinking is possible? Is 'triple helix' morphology any different to the old Goethe-Zwicky version. Might it find us a new way ahead? Is it worth exploring? Only the reader can be the judge. Each person is a quanta of the majority view that controls the ruling paradigm. *If the concept can't inspire the individual it will prove to have no relevance to the whole.*

A secondary result from the experiment arose. He discovered architects tend to see themselves as the servants of humankind, the stakeholders who 'own' architecture. All input is recognised as having value, mostly small, but cherished. This felt rather different to physics where graduating seemed to confer a degree of ownership of nature, excluding the stakeholders. There are subjective elements in architecture, but objective realities are also firmer. Yes, there are many unevidenced theories and views out there, but we know "*nature has revealed to us*", many more 1,000ths of 1%. The job in hand is to identify the evidence from among all the worthless theory. This will never be done while physics is a 'closed shop' with most of humanity excluded and all new theory labelled 'crackpot'. Even the arXiv site effectively excludes 99.9% of humankind. The real problem is information overload. We have to develop better systems and ways of thinking to view, analyse and interpret it.

But there really aren't *that* many crazy theories. The job of weeding out the majority with zero evidential basis would be easy. Objectively considering the rest a little more difficult.

Our peer review journals don't and can't effectively perform this task as they have no imperative or finance to do so. If we really want to ensure we progress it would take a little government funding and some sort of structure.

The logic of claiming that all good theory will get noticed and rise to the fore is flawed in our present system. There is no proof the answer wasn't there 150 years ago and subdued. Let's say Stokes had a true answer but a flawed alternative was followed due to poor knowledge. It could be purely by chance that the real answer was rediscovered 150 years later. The history of physics is littered with such cases. But the greater likelihood is that the 'new' theory would be hocked around, maybe not even read, subdued again and never even become a statistic. The old phrase "physics won't change till the old physicists die" is no longer true if old physicists only propagate clones of themselves. Forums like the FQXi are the foundation of a fresher approach, a model for review funding and should be central to physics.

Do we really risk extinction? Of course, at any time. But secondary effects of experiments often prove the more valuable, and these show we have it within ourselves to control our own destiny and what is possible in physics. But we must be genuinely aware of that. Our attitude is the key to allowing progression. As in 'game theory', progressing to the ultimate in physics is simply a decision we need to take. There's nothing to prevent our survival and ultimate progression to find the whole truth of the universe, except ourselves, and the limits we impose.

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References

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