

## What is 'Fundamental'

### Something not yet found

by Richard Kingsley-Nixey

#### Abstract

Reductionism in science, looking for the smallest possible entities and 'causes' has been discredited philosophically for not being able to explain effects such as 'intuition'. That assumption may now be argued to be false. Learning in artificial intelligence is ever advancing. Reading last years finalist fqXi essays (at least the peer scored top dozen or so) a number of credible schema now exist to model human neural networks and outcomes. <https://fqxi.org/community/forum/category/31425?sort=community> Even the imperfect subconscious process outcomes we label 'intuitive' can be causally & mechanistically recreated with feedback loops. Are we sure we're using reductionism enough, to go deep enough? Not just to observational limits but to rationalization of findings taking us beyond those limits. I argue that we probably haven't yet found, or at least recognized, what's really fundamental in nature.

Philosophical arguments against reductionism seem to have rallied after Richard Dawkins, particularly in his second book "The Blind Watchmaker," [https://en.wikipedia.org/wiki/The\\_Blind\\_Watchmaker](https://en.wikipedia.org/wiki/The_Blind_Watchmaker) (following; "The Selfish Gene")

suggested that more strict systematic scientific discipline should be applied to cultural matters and behavioural 'sciences'. The matter is discussed in the "Oxford Handbook of Causation" ((John W Carroll et al. 2009. p289 - 294) [https://books.google.co.uk/books?id=xGnZtUtG-nlC&pg=PA292&redir\\_esc=y#v=onepage&q&f=false](https://books.google.co.uk/books?id=xGnZtUtG-nlC&pg=PA292&redir_esc=y#v=onepage&q&f=false) Here cases are identified suggesting causation can't be analysed or reduced. But the arguments employ the likes of Merlin and Morgana. For the bio chemist and physicist such arguments are non physical. They may be an over-reaction to Dawkins firm "hierarchical reductionism" stance going beyond causal science to challenge philosophical methodologies and purport to extend to causal physics.

Carroll's view is reasonably expressed as; "*At the very least the anti-reductionist is owed an account of why the intuitions arise if they are not accurate.*" Many of the essays referred above suggest or directly offer such an account. That debt is repaid both by Gödel identifying even maths has '*formally undecidable propositions* so isn't entirely accurate,

and by quantum uncertainty, ensures *nothing* can be entirely accurate. The more quanta involved then the less certainty should exist. But what I suggest we now need to do is to find 'why' that is the case causally, and to even further '*reduce*' in scale to do so.

Acknowledging Dawkins logic but without directly entering the argument we posit that anti-reductionist examples either do not extend beyond the metaphysical or are founded on out of date views of physical science. Ultimately the detractors criticise an expectation of reductionists that some 'super theory' may arise from a reduction of present theories. But I ask 'how do we know it won't unless we keep looking?' We then employ an even greater reductionism, beyond visible matter to rationally theorise on effects found apparently as a result of what we *can't* directly observe. That isn't 'metaphysics' in the same way as much philosophical argument, indeed our most familiar theories are actually based on what we can't see or certainly don't fully understand. What IS 'matter' anyway? let alone dark matter! Time? Space-time? Infinity? Dark energy? and much more including *any* of the concepts in quantum physics? We're only guessing or surmising from a wide range of effects. So why not try extending reductionism, and extending it to *below* observable scales?

Still mainly only spoken of in hushed tones while culture evolves to become familiar with it 'dark' or some form of vacuum energy has been around for well over a century. 'Ether' became unfashionable with Einstein's theory of relativity even though Einstein himself said, though it can't modulate light speed, to remove it entirely was 'unthinkable'. So absolutely nothing bars some 'ether' equivalent that does NOT modulate light speed! Most reading this will be familiar with the concept of 'dark energy' apparently representing some 84% of the total mass/energy of the universe, not to mention the endless list of other effects (which we don't intend to identify & discuss here) such an 'ether' would help explain, from matter itself (via the Higgs process), 'zero point energy' through the more familiar Coulomb force and Casimir effects to the more recent quantum 'foam' (or 'vacuum fluctuations'), quarks and cosmic strings down to the Planck length  $1.62 \times 10^{-35}$  m smaller than which string theory suggests makes 'no physical sense'. But beyond 'matter' we're not constricted by '*physical*' sense. Our experience is limited to what we've seen and surmised SO FAR. Who can say that our '*physical sense*' covers all in the infinite universe/s when we have no idea what's going on at anywhere near that scale? However quote from Wikipedia helps give a better idea of relative scales assumedly *above* that of 'dark energy';

*"The planck mass is much larger than the top quark mass of 173 GeV/c<sup>2</sup>. ...quark size is like comparing an atom to be our solar system and the **quark** would be a tree here on earth". ...can also infer that the characteristic length scale of the top quark is about 10E17 times longer than the planck length. 0.000000000162 ym.*

For those who'd like something a little more technical a first post of call may be quantum field theory and the 'vacuum expectation value'. The Higgs field; is 246GeV and the quantum chromodynamics (QCD) 'Chiral condensate' is 10<sup>3</sup> smaller ) all as outlined here; [https://en.wikipedia.org/wiki/Vacuum\\_expectation\\_value](https://en.wikipedia.org/wiki/Vacuum_expectation_value)

But all theory includes much speculation. We don't wish here to propose any detailed 'theory' in further and even less falsifiable speculation on what may be happening. Rather let's just think conceptually about whether or not we accept 'something' smaller may exist at all. Let's run a straw poll in the blog here to find out it's current cultural status, which is what will dictate whether or not proponents will still be called 'crackpots'. Do give a vote.

If we then accept the 'dark energy' concept, perhaps we all should be considering what sort of 'immaterial' medium might produce the effects we find, such as '*matter*'! The other massive but less visible '*elephant in the room*' is what we call 'gravity'.

So whatever 'it' is (if it exists) will be (genuinely) fundamentally what 'matter' is 'made of' (the 'what' of 'what is spinning') and then also significantly influence how it behaves. At present many find it difficult enough to accept dark 'matter' so few conceive of ignoring culture to go further. A recent paper by Berezhiani et al <https://arxiv.org/abs/1711.05748> suggests a 'superfluid' that;

*'mimics a curved background space-time on which fields can propagate'.*

(Sabine Hossenfelder <http://backreaction.blogspot.co.uk/2018/01/superfluid-dark-matter-gets-seriously.html> thinks; "Superfluid dark matter is without doubt a pretty cool idea.")

More specifically it replicates Milgrom's 'Law' as gravity. However the proposal only ever considers the superfluid in terms of 'matter', so 'dark matter' not anything more fundamental, yet the matter can '*condense*' to '*couple with baryons*'. Large numbers of other candidates for dark matter have been proposed, most refuted, yet scant consideration is given to the more fundamental 'dark energy' concept.

We've certainly 'not yet found' what form dark matter may exist in and it seems we're not yet ready to seriously look for or even consider what form 'dark energy' might take. That part of the proposition of this essay can hardly be challenged. The other part is that such an entity is 'fundamental' to existence. As it ultimately both forms what 'matter' is and how it behaves I suggest the proposition is proved. All other use of the word 'fundamental' to describe theories and effects in physics then seems to be a way to deceive ourselves that there's something we DO know for certain is true which can act as a reliable foundation on which to judge and analyse other effects which appear to be derived.

Now we come to the question of 'recognition'. Clearly we can't 'see' anything below detectable levels but we should find all the evidence needed to advance understanding already exists. It just needs coherent 'assembly'. The idiom that physics is not about new findings but finding 'new ways of seeing' what we've already found has invariably proved correct with hindsight. But in advancing understanding we are then left with a seemingly impossible balancing act. All and any idea or theory may be valid, but there are many thousands out there. Most clearly seem not valid when judged against the 'guesses' that have proved most consistent or popular in the past, but it seems clear that one of those will end up proving close to a correct description.

The Scientific method rather took a back seat since the move to mathematical physics when we couldn't explain effects rationally. Our current approach may then be rather too akin to this; On present theory we say, if wise;

"Yes we're aware it's incomplete and has inconsistencies, but it's the best we have so far"  
Then presented with new concepts we glance at them and often dismiss them, saying;  
"No that can't be right as it varies from current adopted theory"

Our best solution is to maintain recognition that theoretical problems ARE still far from resolved. Perhaps it's that fear of deviating from whatever 'sound basis' we can find is what prevents us from analysing and rationalising what underlies accepted doctrine. Perhaps only when we do so, genuinely look, will we finally find what's truly fundamental in the universe.

*Lasha Berezhiani, Benoit Famaey, Justin Khoury* Phenomenological consequences of superfluid dark matter with baryon-phonon coupling Nov 2011. <https://arxiv.org/abs/1711.05748>