Physicalism Entails Panpsychism.

> How consciousness enters the world is puzzling.[1]

The fundamental assumption we should examine is this: That awareness – the subjective experience occurring in alert human minds – is **not** a basic feature of matter that must be explained by a complete theory of physics.

We can no longer avoid the primary fact of awareness. This is the first and only thing of which any of us can be certain – there is a subjective experience occurring. To avoid having to add in gods, souls, animism, or quintessence., when we try to explain awareness in humans (where we first noticed it), not to mention its probable cohort in the animal world, our good notion of physicalism drives us to consider that subjective qualia must occur in the fundamental ontological entity(ies) of which our universe and ourselves are made. Or at least, might.

The Brute Fact

Physics attempts to understand the world around us, the world in which we find ourselves, and its phenomena. A skeptical position requires us to question all the sacred cows – to apply rational thought and the scientific method to all physical phenomena. We can ask, "How does the classical world emerge from the quantum world underlying it?" Brains are in the classical world. Awareness clearly is intimately related to and dependent on brains. Awareness is an undeniable, given, basic, phenomenon that arises in the classical world from the quantum mechanical world. Rather than assume it is emergent, assume it is fundamental. A wild idea.

> No matter whether the organism or artifact hails from the ancient kingdom of Animalia or from its recent silicon offspring, no matter whether the thing has legs to walk, wings to fly, or wheels to roll with—if it has both differentiated and integrated states of information, it feels like something to be such a system; it has an interior perspective.[2]

Even a trio of quarks? Yes, that is the idea, but in some primitive way we cannot even imagine.

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[1] Consciousness, Confessions of a Romantic Reductionist, by Christof Koch. The MIT Press, Cambridge, Massachusetts. 2012. MIT.
[2] Koch.

The Existential Crisis

Physics is the mother of sciences. The worldview given by the physics of an age provides the shape, structure, origin, and description of the world in which people find and define themselves. The worldview given by religion is a metaphor, an image, or a story that provides an imaginative, intuitive, subjective way to understand and manage one's existence. World models deeply influence the imaginative and intuitive aspects of understanding. Understanding offers reach; vision; insight. To be truly relevant and powerful, such metaphors must stay current with the scientific information and understanding that continually develops through the practice of good science.

Physics, which explains the very foundations and structures of the world in which we find ourselves, is the science that most strongly forms our worldview. And its view these days is not pretty. The view is a world that is chaotic, stochastically determined, cold, and largely unfriendly to life. The appearance of humans is an unlikely accident in a dark, violent, meaningless mash-up of thermonuclear fireballs and crushing blackness.

This is a frightening view for many people. Most of us were raised in institutions and families that held humans to have a special, meaningful, and moral position in the universe. People and institutions naturally react defensively to an empty, frightening world picture. One of the most dangerous reactions is the rise of fundamentalism. This dangerous movement drives public policies that continually lead to destruction of planetary resources, to perpetuation of war, and to erosion of civil liberties.

Anyone who is not captivated by a reactionary fundamentalist fantasy can see that our global discourse is in dire need of a rational model of the universe that includes, in its explanations and understanding, the most fundamental human experience: subjective awareness itself.

We need scientists who study the fundamental structure of the world to study the fundamental structure of consciousness: how it arises from the quantum world. This understanding, however incomplete or tentative, would open the possibility of understanding how human *experience* – not merely human physical presence – fits in to the world.

Darwin's theory gave us an understanding of our place on earth. Astronomy shows us where we fit in the physical universe. Cosmology places us in time. Physics

must explain us the underpinnings; the guts of the matter: What are we? How does the world work? How do we fit into it?

Limits of Current Physical Explanations

The questions remaining at the end of the 20th century indicate that we have hit the wall with our current understanding of the unitary laws of physics. A handful of beautiful and successful theories remain irreconcilable; a unitary understanding remains a chimera. A breakthrough is needed. Recently Dr. Michael Turner said that there is so much wrong with physics that the idea we need will necessarily be wild and crazy. Here are some of the open questions that a crazy, wild new physics must explain:

- What is the ontological entity underlying quantum mechanical phenomena? Is the probability wave a real thing? What is interfering in interference phenomena?
- What is the means of propagating the information about the outcome of a measurement of a probability wave (a.k.a., a particle's state, such as spin) to its entangled partner?
- Why is gravity so weak? Where is the graviton?
- What's wrong with string theory? Why isn't this beautiful set of ideas proving fruitful?
- How does decoherence occur? What interaction with the environment causes this?
- The second law of thermodynamics suggests that our universe began with very high entropy. Do we exist in a random, rare, fluctuation? Or is there really a demi-urge?
- What is the arrow of time? How, or why, does time exist?
- How does the classical world, including my love for my mother and distaste for Salvador Dali, emerge from these entities?
- Is there fundamental ontological entity that brains organize, manipulate, process, filter, and/or record?
- How fundamental is "information", in the Shannon sense?

Awareness is fundamental.

It's like those 4x4 numbered tile puzzles, where you are supposed to order the tiles by sliding them. You get almost done, just need to get that 7 two columns to the

right, and move the 14 up. But wait! You can't do it; you're not close at all. You have to go back and re-shuffle the whole thing!

By leaving mind out, we can't address the most pressing questions about our selves, and we might be cutting off ideas that are whacky enough to be good. How can we study the physics of the world but not include ourselves? We are here; we are part of what is going on. By including awareness in our basic assumptions about the universe, we will gain opportunities for new metaphors that generate new questions. Consider the implications of the basic ontological unit actually being a unit of information. Information units may be processed, generated, minimized, lost, or dissipated in subjective as well as objective aspects.

> That the abstractions of higher mathematics bear some relation to the physical world—in fact, seem to lie at the very heart of its order and operation—is one of the most profound revelations.[3]
>
> A paradox is at work here: ours is a world about which we pretend to have more and more information but which seems to us increasingly devoid of meaning.[4]

In the actual immediate life of you, the reader, there is subjective experience that begs for scientific, creative, deep, rigorous investigation. That subjective experience includes deep feelings, sensitivities, richness of texture and depth, a fullness of personhood. How does this arise from quantum indeterminacy?

Information

Information is classically defined as reduction of uncertainty; a reduction of "possibility". An increase in specificity; in concreteness. Manifest; real.

Information theory treats the fundamental unit of reality as information – bits, or some equivalent. Some difficult physical problems, such as entanglement, disappear when analyzed in terms of processing information, in the Shannon sense.

Information theory offers the following explanation for entanglement. Shine a laser into a tiny pile of calcium ions. The light will excite electrons to higher energy states. When they fall back to their more stable ground state, they will emit the light as pairs of photons. Use mirrors to send these photons off in different

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[3] Deep Down Things: The Breathtaking Beauty of Particle Physics, by Bruce A. Schumm. The Johns Hopkins University Press, Baltimore. 2004. Johns Hopkins University Press.

[4] The Information: A History, a Theory, a Flood, by James Gleick. Pantheon Books, New York. 2011. James Gleick.

directions, one to the north and one to the south. In the south, let your photon hit a device that measures spin. Then you measure yours: Remember, it is a quantum, so it is not really in any spin state. It's in all of them and none of them. When you measure it, it *acts* like a photon and gives you a spin state randomly determined: Up, or down. Instantly and certainly faster than light, the sister photon enters a state. It wasn't really in any state, but when its sister manifests a state, it does too. This is entanglement, and physics cannot explain how this simultaneous action occurs.

But according to information theory, what is extracted from the entire quantum system is *information*. That affects the entire system: entropy increases; probabilities collapse. The information about one particle is information about the system. Once it is extracted, the state of both particles is known. The knowledge was about the whole system; but note that it is known locally to the measurement; it can travel away from that local measurement at no faster than the speed of light. No relativity rule is broken: there is no spooky action at a distance, no unseen element in the system.

When a quantum state collapses, a wave that spreads over any amount of space is instantaneously reduced to a miniscule local region. Henry Stapp says that this constitutes a representation of knowledge rather than a representation of matter.

Giulio Tononi has offered an *Integrated* Information Theory[5] (ITT) to explain how consciousness arises in brains that integrate information in a systemic way. This high provocative proposal offers a framework for exploring ways that awareness occurs in brains that organize, extract, and perhaps synthesize information.

> The theory postulates two sorts of properties in the universe that can't be reduced to each other—the mental and the physical. They are linked by way of a simple yet sophisticated law, the mathematics of integrated information.[6]

It is hard to imagine that the fundamental basis of my car and the solar system and everything is some kind of *data*. But recall that our ancestors saw a world made of four 'energies': earth, wind, fire, water (or variations of this). After Newton, for hundred of years, the world was composed of objects acted on by forces. Since

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[5] Giulio Tononi of the University of Wisconsin–Madison, referenced in "A "Complex" Theory of Consciousness-Is complexity the secret to sentience, to a panpsychic view of consciousness?" by Christof Koch at: http://www.scientificamerican.com/article.cfm?id=a-theory-of-consciousness

[6] Koch.

Heisenberg, it is made of energetic waves of possibility that coalesce randomly. Physics drives an ever-new worldview.

Heisenbergism leads us to today, back to information. Here's how. These random fluctuations of possibility appear, in some experiments, to be affected by choices of an outside observer. In controlled experiments where a possibility fluctuation is humming along unimpeded, you can measure its 'position'. When you do, it hits the wall like a little particle. Or, you can decide to split the possibility fluctuation into two, and watch how they interfere with each other as waves. The possibility fluctuations show up as waves when you want to see that, or particles when you look for that. But it really is neither. What is it?

No one has any idea. Is it a mathematical abstraction? That is, is it information?

Large, statistically predictable patterns of this unknown stuff allow things to exist temporarily: neutrons, electrons, stars, water, ice cream, iPods, feet. These things interact in a causal way; once you get a few degrees of freedom away from the pesky quanta, things behave as you'd expect – apparently as objects affected by forces, like electromagnetic force and gravitational force. How does this classical world, including you, emerge? No one has any idea.

This is the model of the world we have coming into the 21st century.

This model is so alien, few of us absorb it into our sense of self and identity. How could it be that this self, which I so clearly and fundamentally am, is an effect of a kergazillion vibrations in a googolplex of universes of quirky quanta? Then why do I feel so real? Why do I feel so *deeply*?

Something is missing. Einstein looked for it, the daring string physicists looked for it; Claude Shannon may have inadvertently found it. Perhaps the basic unit of physical and subjective ontology is information.

Scientifically Legitimacy

Christof Koch, Roger Penrose, Stuart Hammeroff, Paul Davies and an increasing list of accomplished and brilliant scientists have pulled consciousness into the realm of things physics can, and should, probe. Consciousness is the elephant in the room. We have to explain it. Dual aspect monistic pan-psychism, entailed by physicalism, is a great place to start.

Tononi's Integrated Information Theory (IIT) formulates a framework that leads to testable predictions. That framework can be enhanced such that we could begin translating phenomenal experience into the language of science: mathematics.

I appeal to the physics community to take the lead in helping humanity shape a model of the universe that includes us; that explains us, as we are and as we richly experience ourselves. The great chain of being model has died; the objects and forces model is superseded. The chaotic random quanta model is shaking every fundamentalist reactionary tree in the world and producing dangerous fruit.

We need to understand ourselves; awareness is fundamental to what we must understand. We can let the philosophers trap us in a Chinese room, we can wait for the computer geeks to build one of us out of germanium, we can wait for the neuroscientists to locate the definitive neural correlates of consciousness. In the end, awareness is so core, so central to our identity. We ask, "What are we?" "What is going on?" "What are we made of?" "Is there something we supposed to do?" The first three are core to physics. The last has been the province of religion. Many strong and broad thinkers, including Stephen Jay Gould, thought this was good enough. Science figures out the world, religion coaches on the ethical and meaning questions. I don't buy it. What we are, came from this: This world. We can't be different. We aren't anomalous. Mathematical analyses show we are predictable outcomes in universes like ours. We were bound to happen. So this awareness thing is bound to happen. It is something the universe does. In all universes like this, awareness is happening. Why don't we explore it?