physicalism

> "The most important and exceedingly difficult task of our time is to work on the construction of a new idea of reality."
>
> — Wolfgang Pauli

Almost a century after the initial discoveries of the quantum nature of matter, and many decades after they were confirmed beyond serious question, even many well-educated people do not know that quantum physics appears to have upended a conception of reality that has been in place since the 17th century. Far from just an academic abstraction, knowledge about the quantum nature of matter has profound implications for how we view the world and our place within it, and, consequently, for many of the most important aspects of human society.

As one of the primary founders of quantum mechanics, Wolfgang Pauli saw more clearly than most just how revolutionary the discoveries of the quantum nature of matter would be to long-standing, fundamental notions about the nature of the world. This is what led him to declare that our most important task is to construct "a new idea of reality." He may have also understood how strong the resistance by the scientific establishment was likely to be. And that resistance has proven to be very strong.

Classical model of physics

For the better part of two centuries the scientific community has for been committed to what is known as the classical model of physics— or, at least for western thinkers, the standard model of reality. This conception of the world, and the idea that Pauli believed needed to be replaced, holds that the universe consists exclusively of physical stuff, of particles, fields, and forces that affect them, all moving deterministically[1] through space and time. Nothing exists that cannot be reduced to description by physics, at least in principle. And it's all completely independent of consciousness— we are merely observers of a reality that we can have absolutely no effect on.

This view of the universe, typically known as "physicalism,"[2] has been the basis of our scientific program since the days of Galileo, Newton, and other founders of the Scientific Revolution— and it continues to be an all but unchallenged worldview among most contemporary scientists and philosophers. Indeed, it is a belief that has been so long and thoroughly engrained in the modern scientific program that it has effectively become a scientific dogma. Even now, decades after incontrovertible evidence overturning the classical model, very few contem-

porary academics actively challenge it, and those who do often endure scorn and even personal vilification by their orthodox colleagues.[3]

Before the advent of QM there were no serious challenges to physicalism from the scientific community: even at the cusp of the 20th century most scientists believed that physics was more or less complete and that the only remaining work in physics was in marginal, mathematical details. But many of the founders of QM quickly recognized the philosophical implications of their findings[4] (Einstein was a notable exception).[5] Pauli was far less subjected to such attacks, perhaps because he understood QM better than just about anyone.[6]

Physicalism is incomplete

But physicalism is ultimately a belief held by scientists and philosophers, not a discovery with supporting experimental evidence. Moreover, the narrative of strict physicalism is at best incomplete, and as a representation of the true and fundamental nature of the universe, it is simply wrong. Modern physics, particularly quantum mechanics, has shown that the classical model of physics is only an approximation of a far more complex reality. The classical idea of a more or less mechanical universe— that all things can be best understood by reducing them to their smallest parts, and that at bottom matter consists of discrete particles (electrons, neutrons and protons, etc.) moving in space and time and acted on only by the forces of gravity and electromagnetism— that idea has been shown to be false.

According to the perspective of matter held by most of the founders of quantum mechanics, there are no "real" electrons, quarks, or other particles that exist as immutable entities "out there" interacting independently with other particles according to the laws of physics.[7] An electron (or any other particle) is instead a "cloud of potentialities"[8] that extends to infinity. A particle only appears when thefield of probabilities (the cloud of potentialities) in what is called a "wave function" suddenly emerges (or "collapses") as a single point in space time.[9] At this point, and only at this point, can a particle interact in specific and predictable ways (such as chemical interactions). Decades of experimental evidence has, without exception, shown that the "collapse" of a probabilistic wave function (or distribution of potentialities) into an observable particle is tied to the intention of the experiment, or of an "observer."

But if reality consists of more than physical objects and the forces that affect them, what is the world, at bottom, really made of? If physicalism is not reality, full-stop, then what is? Or is it even reasonable to think that there is a "full-stop" explanation?

Possible elements of a new idea of reality

One might think that in the age of science the basics of reality are clearly and unequivocally understood. Putting aside the dogmatic perspectives of scientism, that does not appear to be the case.[10] And the gap between what is widely accepted as true and what may very well be true is quite wide— wide enough to indicate that a new way of looking at the world may be in order. This is where things get very complicated. And, it seems reasonable to conclude, this is where what appears to be our deep-seated need for certainty very much gets in the way. Most of us really do believe that there is an "ultimate way of the world," a narrative that, at least in principle, is a sufficiently complete and accurate description of the way that things really are. As Thomas Nagel put it:

> "It may be frustrating to acknowledge, but we are simply at the point in the history of human thought at which we find ourselves, and our successors will make discoveries and develop forms of understanding of which we have not even dreamt. Humans are addicted to the hope for a final reckoning, but intellectual humility requires that we resist the temptation to assume that the tools of the kind we now have are in principle sufficient to understand the universe as a whole."[11]

The need for, or even a belief in, some ultimate certainty is a major impediment to moving beyond the classical worldview we are currently stuck in. Although intellectual honesty compels us to acknowledge that the idea of an omnipotent God may indeed be true, intellectual honesty also compels us to acknowledge that that is extremely unlikely.

##We Need Better Models

—we need more and better models What can we hold as "truth"? Coherence vs correspondence notions of truth: we cannot hold out for final correspondence, for a final reckoning of the way the world really is. In the meantime, we can accept the coherence aspect of a defendable narrative about the way the world probably is. and that this or that current perspective is, depending on one's worldview, aligned or contrary to that ultimate way.

The Nature of Matter

The universe, everything that we perceive with our senses, is made of matter, of solid stuff (liquids and gases are simply different phases of matter). We can measure it and make things out of it. Matter and energy are different forms of the same stuff, at least to a reasonable approximation, and at least in theory can be converted into each other.[12]

Nuclear power comes from converting matter into energy.[13] But The stuff the visible universe is made of— stars, planets, penguins, etc.— apparently only comprise about 5\% of the total mass in the universe. The rest is known as "dark matter."[14] Most contemporary scientists and philosophers believe that matter and its equivalent have good reason to believe that matter is no longer being created, but that it be converted from and into energy.

We have good reason to believe that the myriad of particles that make up atoms, the smallest bits of identifiable matter, exhibit the characteristics of a particle under specific circumstances but otherwise exist as what is referred to as a wave function— an effectively infinite distribution of probabilities. But particles, and even the "empty" space between them, are at bottom unimaginably tiny fields of energy. The properties of matter that we can measure— mass, electric charge, momentum, etc.— are only mathematical constructs associated with those particles, quarks for example, that successively combine to form what we identify as matter.

Why the classical worldview is outdated

Quantum mechanics has revealed that objects are simultaneously particles and waves until they are "measured"— but it isn't clear just what "measurement" includes, but it definitely includes consciousness. Esoteric philosophies and eastern religions have long held that the physical world is a manifestation of something much greater. The hard lesson here from the point of view of classical epistemology is that there is no godlike perspective from which we can know physical reality "absolutely in itself". What we have instead is a mathematical formalism through which we seek to unify experimental arrangements and descriptions of results.[15]

> "It seems to me that the lesson of quantum mechanics is that we should drop the whole idea of there being a canonical description
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> $$of reality$$
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> . Galilei's book metaphor is profoundly misleading. There is no mathematical description in the sky. The only descriptions around are the ones we humanly construct and which, being human, are necessarily partial.[16]

The classical worldview and consciousness

> "The issue here is not whether distinct objects that we observe via our senses can be treated as classical objects. It is whether in the description of the complex inner workings of a thinking human brain it is justifiable to assume — not just for certain simple practical purposes, but as a matter of principle — that this brain is made up of tiny interacting parts of a kind known not to exist."[17]

Could it be that a great many if not most of today's scientists and philosophers are like the inhabitants in Edwin Abbey's Flatland? Are they "satisfied with their universes", as Isaac Asimov put it? Are they:

> … not only incapable of understanding the limitations of their view but are enraged by any attempt to enfource them to transcend those limitations….
>
> *Abbey's ∗ Flatland∗*
>
> then, should lead us to question the limitations we set to our Universe generally, not only those that are mathematical and physical, but those that are sociological as well. How far are our assumptions justified, and to what extent are they merely careless, or self-serving, misinterpretations of reality?"[18]

This is a story, told in various segments, about why we need a new view of the world and some ideas about what that new worldview might or should include.

Yet far from having a thorough understanding about the fundamental nature of matter, science has discovered that matter is a notoriously difficult concept idea to meaningfully pin down with specificity. It is striking and ironic, then, that modern physics has shattered this narrative. Many believe, reasonably enough, that the contemporary perspectives Western religions are insufficient for those seriously interested in an integrated worldview. Eastern religions (including Buddhism, although it is often considered to be more of a philosophy than a religion) typically have more nuanced perspectives. Some elements of eastern spiritual thought are included in this project, but for the most part it focuses on what, for lack of a better term, could be called "the western mindset."

[1] Roughly speaking, determinism is the idea that objects will maintain their existing state unless acted on by another object or force.

[2] The term "physicalism" is used here in a generally used in reference to what might be better called "strict materialism" to distinguish between the belief that matter matters and the belief that matter is all that exists.

[3] The story behind what is referred to as "quantum foundations" and resistance to it by the greater physics community is fascinating— see *What is Real?* by Adam Becker, for example.

[4] Heisenberg's "The Philosophical Implications of Quantum Mechanics" for example.

[5] Einstein did not accept the core aspect of QM: that at bottom matter (and therefore reality) was probabilistic. He believed that QM was incomplete, and that a fully deterministic explanation would one day be found— a belief that was later terminally put to rest by John Bell.

[6] In the early days of QM only a few people knew enough about it to intelligently discuss it. Some decades later, Richard Feynman said something to the effect that anyone who thinks they understand quantum mechanics can't possibly know what they are talking about.

[7] This is admittedly something of a gross over-simplification, but it is close enough for the current purpose of illustrating that modern physics requires a fundamentally different way of looking at the world, particularly at an atomic level.

[8] A term used by Henry Stapp in "A Mindful Universe"

[9] Another finding of modern physics is that space and time are inextricably connected in the space-time continuum described by Einstein in his General Theory of Relativity.

[10] That the modern scientific program misses a very large part of reality is a primary premise of this project. At this point, however, it is simply an assertion.]

[11] Thomas Nagel, *Mind & Cosmos,* p. 31

[12] Mass and energy are equivalent but different ways of expressing the same stuff. This is taking a bit of literary license, as mass and matter are technically different: mass is but one of several properties of matter, and matter is anything that has mass and volume.

[13] It is theoretically possible but highly impractical to convert energy into matter, because it takes a tremendous amount of energy to do so.

[14] There is some controversy over this: see Modified Newtonian Dynamics, (`https://ui.adsabs.harvard.edu/abs/2002ARA&A`..40..263S/abstract)

[15] *Conscious Universe*, p. 76 (Kafatos & Nadeau)

[16] Marcus Appleby, "Mind and Matter: A Critique of Cartesian Thinking", in *The Pauli-Jung Conjecture*, p, 31

[17] Henry Stapp: "Attention, Intention, and Will in Quantum Physics", p. 13

[18] Isaac Asimov, "Limitations", Introduction to *Flatland*, Barnes & Noble edition, 1983