

# The Tragedy of Science and a Way Out

By Donald D. Hoffman

It is occurring to more than a few observers that science, which often has to do with trajectories, may exhibit a trajectory of its own: having been launched in the ‘scientific revolution’ (1550–1700), and achieved its apogee with the spectacle of “atomic energy,” (1944) it now finds itself mired in the shallows and miseries. Albert Einstein submitted his first paper on the Unified Field Theory in 1915, over a century ago. This grand scheme should have integrated general relativity with electromagnetism, yielding a single comprehensive law applicable to basic forces. But what might have stood as the fulfillment of the Enlightenment eluded the illustrious Einstein -- along with everyone else. Instead of clarifying the relations of quantum physics and general relativity, our best minds these days generate an ever-expanding smorgasbord of hypotheses, including quantum gravity, string theory, loop quantum gravity, ‘theory of everything’, and supersymmetry, none of which commands assent. It’s beginning to look like the trajectory of science lands in tragedy.

Writing in ThoughtCo, May, 2018, Andrew Zimmerman Jones noted:

*The current problem with a fully unified field theory is in finding a way to incorporate gravity. . . with the Standard Model that describes the quantum mechanical nature of the other three fundamental interactions. The curvature of spacetime that is fundamental to general relativity leads to difficulties in the quantum physics representations of the Standard Model.*

Hence the interminable array of rival metatheories cluttering blackboards the world over. Whatever sympathetic journalists may say to assuage a curious public, the scandal remains. Think E=MC<sup>2</sup>. The sort of elegance and consistency demanded by the canons of physics has been conspicuously missing since Einstein first lamented his inability to close the gap.

The fate of “cosmology” is even more grim. Think of the casual use made of the term “universe.” What, if anything, does it denote? Can there be more than one? Does it come when you whistle? It is not that the project of fathoming our cosmic environs is merely incomplete; rather, it seems to founder in a welter of incongruous and unassimilable data. This isn’t merely a lay impression; it emanates from those most intimately involved in the project. Hearken to Thomas Kitching, Professor in Astrophysics and Royal Society University Research Fellow at University College, London, writing in Phys.Org in January of 2016. In a paper titled “Cosmology is in Crisis—But Not for the Reason You Think” we encounter a stark admission of incapacity.

*Science is advancing rapidly. We are eradicating diseases, venturing further into space and discovering a growing zoo of subatomic particles. But cosmology — which is trying to understand the evolution of the entire universe using theories that work well to describe other systems — is struggling to answer many of its most fundamental questions. We still have no idea what the vast majority of the universe is made of. We struggle to understand how the ‘Big Bang’ could suddenly arise from nothing or where the energy for “inflation” — a very short period of rapid growth in the early universe — came from. But despite these gaps in knowledge, it is actually human nature — our tendency to interpret data to fit our beliefs — that is the biggest*

*threat to modern cosmology.* (Emphases added)

It seems that just as we are on the brink of getting the big picture something goes awry. But what – and why? It was all well and good for Renaissance savants to calculate the velocity of falling bodies or train their telescopes on a more intelligible night sky. These exercises yielded important lessons. But insuperable challenges lay just ahead. Copernicus confidently showed in 1543 that earth is best understood as a planet along with its siblings circumambulating the sun. Our cosmos, then, is heliocentric. QED. Yet it was just at this delicate juncture that things started to unravel. Recall that Copernicus did no more in his treatise than situate the sun at the center of a spheroidal system. Everything turns round it, including the fixed stars. But unlike those wrestling with the cosmos today, Copernicus maintained a *finite Weltanschauung*. Expressly ruled out was the idea of infinity which Democritus, Epicurus and Lucretius had promoted. Unfortunately, the dialectic could not rest at this critical point. For it seemed inviting, indeed compelling, to view the sun as just one more star in a seemingly endless spatial expanse, thus reviving the outlook of Democritus & Co. In the latter half of the 16th century an ecstatic Giordano Bruno went about proclaiming the reality of infinite space, even taking his breathtaking message to an awakening England, where around 1582 it was picked up by a shocked William Shakespeare (See, e.g., *Hamlet*, 2.2.247-248). In the early 17th century the concept of infinite space passed to its most eminent and influential exponents, Galileo Galilei and Isaac Newton. Two hostile camps faced each other, one headed by Copernicus (supporting a finite cosmos) and the other by Bruno (championing infinity). Bruno was executed for his forwardness by the Roman Inquisition in 1600.

Space had again become problematic, an abyss that seemed to swallow up thought. So long as we were satisfied with finitude or bare “infinity” we could hobble along. But that is precisely what could not be done, as jaunty cosmography cascaded into troubled cosmology, requiring analysis of our most basic ideas, or as Kant was to put it later, “the forms of sensibility.” The vexed issue lurking behind the mathematical arras was, ‘Is space a puzzle to be solved -- or a polite encounter with our built-in cognitive boundaries?’ As the gnomic Austrian philosopher Ludwig Wittgenstein (1889-1951) would lament in the 20th century, “to think a limit is to think both sides of that limit,” pointing to the Janus-faced aspect of physical reality. Needless to say, stirring into the cauldron the non-Euclidean geometries of Nikolai Lobachevsky and Bernhard Riemann only made a witch’s brew more fair, more foul, as it entailed two opposed portraits of “curved space.” Yet according to booster Stephen Hawking, there is no difficulty. Science has no need to examine itself in the manner of fuddy-duddy philosophy. In a review of Hawking’s 2010 book, *The Grand Design*, one commentator sums it up:

Philosophy has not kept up with modern developments in physics, particularly particle physics. Scientists have become the bearers of the torch of discovery in our quest for knowledge. (See, review in “Age of the sage”)

“Bearers of the torch of discovery,” then, have no need of philosophical reflection. But on closer inspection we find imbroglios. While contemporary scientists bicker among themselves about the confusing web they presume to untangle, the countenance they turn to the public is one big smiley face. In a 2018 “Full Frame” interview on CGTV hosted by Mike Walter, Professor Nima Arkani-Hamed of the Institute for Advanced Studies in Princeton, New Jersey (Einstein’s old stomping ground), soon to be director of the world’s largest Hadron Super-Collider in China, held forth on the nature of modern research. He freely granted that for every answer his discipline proffers it raises a hundred questions, and thus it is au fond a self-defeating game. Its only value, Arkani-Hamed avowed, is to pique our curiosity. Here is a refreshing candor

indeed: it isn't the philosophers who are behind the times, but Mr. Hawking, whose "Excelsior!" must strike us as terribly out of date.

If we turn from theory to praxis we fare no better. Yes, the litany of medical, technological and industrial triumphs is more than impressive, and many see it as no less than miraculous. But at the same time, diseases grow immune to our vaccines, nuclear weapons proliferate while reactors such as Chernobyl and Fukushima fail, contaminating wide areas, global temperatures soar, and our oceans teem with billions of tons of plastic. Hunger and famine stalk the world as the Amazon "rainforest" goes up in smoke. Look carefully at humanity's various "space programs" and you will find that many of them, including our own, are premised on a view of earth as an expendable neighborhood. Future generations will transmit the blessings of science to galaxies still unfound in the new romance of "space." What is this projected 'Space Odyssey' but an acknowledgement of terrestrial failure? It is fair to ask, then, Have we reached the point of diminishing returns? If science rests essentially on experiment, and experiment seeks knowledge not yet attained, how do we avoid accident and catastrophe? Leading physicists point to the dangers at CERN of trying to punch through to parallel dimensions: our 'universe' might shrink to the size of a basketball.

In such dubious circumstances it is only prudent to repair to our wisdom traditions. At the dawn of the West, Heraclitus (500 BC) cautioned that "Physis (nature) loves to hide." This monitory dictum stands as a caveat to our gnostic friends who rush into their laboratories with the confidence of lemmings. Recall that Phaethon lost control of the chariot of the sun. Can we do better? Perhaps the nature of things is garbed in the modesty of Artemis, and we risk the fate of Acteon. Recall that Socrates (469-399 BC) abandoned natural science and cosmology as speculative and productive of intellectual dissension. Zeno of Elea (495-430 BC) proved that duality is duplicity and that motion and change generate paradoxes. Pythagoras (500-475 BC) in his mathematical zeal stumbled on the irrational quantity  $\pi$ , which so alarmed him that he squirreled the news away and threatened his followers with death if they made this fatal fact public. Pyrrho of Elis (360-270 BC), the founder of Skepticism, demonstrated tirelessly that every intellectual contention elicits its contrary; hence 'Knowledge' must be a mirage, a chimerical charm tempting us to folly and unhappiness. In the modern era, Immanuel Kant (1724-1804) paid careful attention to Copernicus and Galileo and their competing notions of space, time, and causality. He famously showed all such categories to be products of the human mind, prismatic filters through which we contrive the fabric of our experience, and which, when pressed, yield the same impossible antinomies and paralogisms disclosed ages ago by Zeno of Elea. Finally, the English philosopher FH Bradley (1846-1924) showed beyond peradventure in *Appearance and Reality* (1893) that all aspects of modern knowledge are based on a structure of relations which are irremediably contradictory and can only be viewed as appearances masking an ultimate absolute.

These seven figures represent the judgment of philosophy in its major key, one which sets a bourn to human understanding. Their arguments have been passed over but never overturned. Had the trajectory of science leaped into the Beyond untrammelled by problems and paradoxes there might have been less reason to cite these thinkers today, but as we have noted, the course of true calculation never did run smooth. Science has fractured into factions, tussling over ideas we need to buttress our grasp of nature. It is therefore appropriate to raise the question of whether the collision of scientific concepts is a mere bend in the road to omniscience, or a confirmation that physics cannot and will not complete the project inaugurated in three centuries ago.

Implicit in modern skepticism is a signal insight: our categories are at odds with themselves because the nature of the human mind is, as Heraclitus implied, incommensurate with the very nature of things. We are the mask worn by reality. Science is, after all, a refinement of anthropoid apperception; though it seems we gaze through a clear window onto a pre-formed world, in fact we fashion what we behold according to our peculiar structure: hands with opposable thumbs, binocular eyes, agile tongues and hyperactive cerebral cortices. Sadly, there is no privileged access to the Real. Consider the praying mantis, with its five eyes and preternatural patience. The world we ken is not the one it knows. Perhaps it is the mantis which abides in that fabled ‘unified field’. Nature still has much to impart to us, if only we will listen.