

## CHAPTER 4

## Science after Einstein

For nearly four hundred years Western thinking has been dominated by modern science. For most of this time it has been a major problem for faith. Today this is changing. There is a new science, a new kind of scientific mentality that opens up vast new possibilities for spirituality and faith in God. This change constitutes one of the truly great signs of our times.

## The Scientific Mentality of the Past

The principal architects of the scientific worldview were Francis Bacon (1561–1626), René Descartes (1596–1650), and Isaac Newton (1642–1727). There were others, but these *men* might well be called the *fathers* of modern science.

Science for Bacon was *man's* conquest and taming of nature. Women were seen as part of nature; they could not be counted among the scientific conquerors of nature.

For Descartes, the human body was simply a machine. The rational thinking mind, though, was something completely separate and superior—the ghost in the machine.

Newton saw the whole universe as one gigantic machine. He spoke of it as a clock that had been created by God, wound up, and then left to carry on ticking.

In this worldview, the universe is a collection of objects, the smallest of which are atoms. They operate like the parts of a

machine, mechanically and predictably, according to the strict laws of physics, the laws of gravity and motion, and in conformity with the properties God has given each atom. This was a scientific worldview in the sense that it was based upon measurements, controlled experiments and empirical evidence—the “facts” as they appeared to be in those days.

The famous discoveries and inventions of the Industrial Revolution were made possible by this mechanistic worldview. It was Newton's careful study of the laws of gravity and motion that enabled technology to build more and more sophisticated machines.

This seventeenth-century mechanistic worldview became the norm for all scientific endeavors. John Locke saw society as a machine in which the parts were isolated individuals pursuing their own selfish interests and able to cooperate with one another only by means of social contracts. Freud's scientific study of the human psyche and especially of the unconscious mind, brilliant though that study was, was limited by the mechanical and materialistic framework of Freud's thinking. Marx's scientific socialism, based upon his careful analysis of capitalism and his predictions about its future, was deeply influenced by the mechanistic understanding of what “scientific” means. Even Darwin's scientific study of evolution was limited by the view that the only mechanical way in which one species could evolve from another was by natural selection. Western medicine suffered from the same limitation. The body was seen as a kind of sophisticated machine.

In fact, this kind of scientific mentality has influenced the thinking of most of us, especially those who have had a typical Western education in science. There have been and still are exceptions: mystics, poets, artists, some people of faith, those in pre-modern cultures, and generally, in almost every part of the world, women. In terms of the mechanistic worldview, the thinking of these groups has been regarded as unscientific, superstitious,

and magical, but mostly harmless. As the scientists saw it, such irrational ways of thinking contributed nothing to the progress of "mankind."

God was completely absent from this world. If God existed at all, it would have to be in some other spiritual or supernatural world. Hence the two world schizophrenia that most of us grew up with, the dualism that separates the material world from the spiritual world, the body from the soul, creation from the creator.

Then came Albert Einstein (1879–1955).

### The New Science

It is not for nothing that Einstein's name has become a household word for exceptional intelligence. He was a genius like no other. What he and many others during the last hundred years have been able to demonstrate is that the mechanistic worldview that we call science is simply *unscientific*. And while it took some time for the consequences of his discoveries, and other similar discoveries, to be appreciated, today the vast worldwide community of scientists, with few exceptions, has moved beyond the mechanistic view of reality.

What is really significant about this world-shaking paradigm shift is that it is *scientific*. The mechanistic worldview has been dismantled by innumerable experiments, by meticulous measurements, by hard empirical evidence. The mechanical hypothesis can no longer account for the "facts" as scientists know them today.

Although most people have not really caught up with it yet, the new scientific mentality is here to stay. It is the way almost everyone will think in the not too distant future. It will change our consciousness as nothing has ever done before. It stands today as a sign of a very exciting tomorrow.

So, what is this new scientific worldview? We begin with some of the well known discoveries of quantum physics.

### Quantum Physics

One of Einstein's great discoveries was that energy and matter were, in the words of Bill Bryson, "two forms of the same thing: energy is liberated matter; matter is energy waiting to happen."<sup>1</sup> Nor was this some kind of vague theory. Einstein actually measured the amount of matter (its mass) that would be the equivalent of a particular amount of energy. Hence the world's most famous formula:  $E=mc^2$ .

This could simply not be reconciled with the mechanistic model of physics because energy was supposed to be an activity or movement and matter was supposed to be a thing. How could a thing become a movement and how could an activity become a particle of matter?

But this was just the beginning. Einstein also discovered that light sometimes behaves like a particle and sometimes like a wave. The mechanistic scientists had already decided that light must be a wave and therefore they jumped to the conclusion that there must be some kind of substance in which light waves were moving. They called this hypothetical substance "ether."

Today the scientists tell us that there is no such thing as ether and that light is neither a wave nor a particle. The truth is that our human minds are limited. We cannot understand light; we can only treat it *as if* it were a wave, and for other purposes *as if* it were a particle. In fact it is neither; it is something beyond the human mind and imagination. For us, light is a *mystery*.

Light is a form of energy and energy is of course equally mysterious—although not nearly as mysterious as the atom. When Einstein and numerous other scientists "opened up" the atom and analyzed its "contents" into electrons, protons, neutrons, and numerous other "particles" right down to infinitesimally small quarks, they soon realized that they were not in fact dealing with particles, nor waves, or any other recogniza-

ble objects. They were dealing with patterns and relationships. But how can you have patterns and relationships with nothing that is being patterned or related?

The mystery only deepened when the great physicist Niels Bohr came across the quantum leap. Electrons, which we have to treat as particles moving around in an orbit, sometimes *jump* from one orbit to another without passing through the space between the two orbits. How is that possible?

There are any number of other puzzles that defy explanation, not because we do not have enough evidence but because in the subatomic world the empirical evidence is self-contradictory. There seems to be no logic or rationality down there. It is, to us, a very strange world.

The latest theory, or way of describing what appears to be happening in the subatomic world, concerns the quantum vacuum. Ninety percent of any atom is empty space, a vacuum. There is nothing there, not even the hypothetical ether. But electrons and all the other “particles” that seem to be spinning around in the atom emerge out of this nothingness and then disappear again into it. In the words of the mathematical cosmologist, Brian Swimme, “elementary particles crop up out of the vacuum itself—that is the simple and awesome discovery... the base of the universe seethes with creativity.”<sup>2</sup> Further on he becomes almost mystical about it: “I use ‘all-nourishing abyss’ as a way of pointing to this mystery at the base of being.”<sup>3</sup>

The quantum physicist who has studied this phenomenon more than most, David Bohm, speaks of the implicate order and the explicate order. The implicate order is the creative vacuum, the universe’s unbroken wholeness, which is invisible because it is not available to our senses. The explicate order is the multiplicity and diversity of things and events that arise out of the implicate order and present themselves to us as empirical evidence.<sup>4</sup>

The universe is not what it used to be. It is not a machine. It is a mystery.

## The Universe Is Expanding

Another of Einstein’s discoveries was so extraordinary that, for years, he himself could not believe it. His calculations led to the conclusion that the whole universe was either contracting or expanding. That was too much, even for Einstein. But then a few years later the astronomer Edwin Hubble (1889–1953) provided incontrovertible evidence for the phenomenon of a rapidly expanding universe. Before Hubble, the only galaxy we knew about was our own, the Milky Way, and that was not expanding because galaxies are held together by the force of gravity. Today we are aware of something like 140 billion galaxies out there, many of them discovered by Hubble, and they are all moving away from one another in all directions at an ever-increasing speed!

Einstein’s calculations had not been mistaken. Years later he spoke of this cover-up of his conclusions as the greatest blunder of his life.

The next step was to read backwards from the present moment to a point in time and space when everything must have started expanding outwards. Known to many as the “Big Bang,” it is estimated to have happened between thirteen and fifteen billion years ago.

Some hundreds of thousands of scientists, the best known being Stephen Hawking, then went to work trying to trace the many steps in the evolution of the universe from the first great explosion of pure energy through the development of protons, electrons, atoms, molecules of hydrogen and helium, stars, supernovae (exploding stars), galaxies, planets rotating around stars, and then, on planet Earth, the evolution of life, of which we are an outstanding example. And what a story it has turned out to be.

Much has been written about this unfolding development, but it was Brian Swimme and Thomas Berry who put it all together

as one long and exciting story in their book, *The Universe Story: A Celebration of the Unfolding of the Cosmos*. It has become the new creation story that has already fired the imaginations of hundreds of thousands of people. We call it the new cosmology.

After literally millions of experiments and calculations, what we have today is a new worldview that sees our unbelievably vast universe unfolding at an incredible speed from a point smaller than anything we could possibly imagine. And if that does not boggle the mind, we can try to grasp what scientists mean when they tell us that there is no space outside of this universe and no time before the Big Bang, because space and time are created along the way as the universe expands. If you can imagine yourself traveling at some impossible speed toward the edge of the universe, you would eventually find yourself back where you started—because of what Einstein called the curvature of space.

As the biologist J. B. S. Haldane once observed, “The universe is not only queerer than we suppose; it is queerer than we can suppose.”<sup>5</sup>

### Self-organizing Systems

Biologists have long given up the idea that living organisms are just like machines. Medical practitioners today recognize the ineffectiveness of treating the human body as a separate mechanism. They speak about holistic healing, treating the whole person, and including the person’s social and physical environment.

Today living organisms are described as self-regulating systems. They organize themselves, nourish themselves, heal themselves, propagate themselves, protect themselves, and interact creatively with other systems.

We used to call this instinct—in animals if not in plants. Today we talk about genes that have coded messages or in-

structions that connect with one another in a DNA spiral in the nucleus of every living cell. If we were to write out the instructions contained in any one tiny DNA spiral we would fill about a thousand books of six hundred pages each.

What this means, in the words of Fritjof Capra, is that “the organizing activity of living systems, at any level, is *mental activity*” (emphasis mine).<sup>6</sup> All living things have minds of one kind or another. Mind here is not a thing or an object. It is a particular kind of process. Living and knowing are inseparable.

The human mind, however, is different. Not only is it a more complex process, but, because it is so close to us, it is even more mysterious to us. We call it *consciousness*. Psychologists and mystics have tried to say something about this phenomenon, but it is so basic that it cannot be explained in terms of anything more basic. It has been noted that the most fundamental thing in existence is not matter or atoms or quarks but our own consciousness.

Much study has been done on the phenomenon of consciousness. We can know something consciously or unconsciously. We can become conscious of being conscious. We can become conscious of ourselves as the ones who are conscious (self-consciousness) and it seems that we can experience consciousness as such, with no particular object.<sup>7</sup>

Another interesting way in which the mechanistic worldview is being transcended is through discoveries having to do with chaos theory. It seems that systems of various kinds often exist in a state of chaos or, as they say, “on the edge of chaos,” and then suddenly and unpredictably there emerges something called a “strange attractor” that rearranges the chaos into some new order.

Predictability had been the cornerstone of Newtonian physics and of the great advances in technology. This is still true at some levels, but not always and everywhere, it seems. Scientists are discovering more and more events that could never have been predicted. The mystery deepens.

## Holons

Science and philosophy had always operated on what is called linear causality: A causes B causes C and so forth. But if one just thinks about it, any particular event has multiple causes, conditions, and influences, not to mention the reactions we call feedback. One has only to think of the role of temperature, pressure, the ecosystem, and other surrounding events to realize that there is no possible line of causality that is independent and disconnected from everything else that is going on. There is always a whole web of causes and conditions, and each one of these causes and conditions is the result of a further web of causes and conditions until the whole universe since the beginning of time is seen as in some way involved in any particular event! Everything—without exception—is connected to everything else.

The universe is not a collection of objects; it is a system of systems within systems. This applies to more than just living organisms. Every natural thing is a system and part of a system, a whole and a part of a greater whole. “Holon” is the word that has been coined for this.

Perhaps the final nail in the coffin of the mechanistic worldview was the discovery that the whole, any whole, is greater than its parts, and that it is the whole that determines how the parts will behave. A machine like a clock or a car or a jet plane is not a whole. It is nothing more than the sum total of its parts working together. But natural wholes from living organisms to ecosystems to galaxies operate differently. Each of them is more than the sum total of its parts.

This is why some scientists today speak of the earth as Gaia. It is not a living organism like a plant. It does not reproduce itself, but it does seem to be self-regulating. In some mysterious way the earth as a whole, as a “self,” regulates the temperature, the impact of the sun’s rays, and so forth in order to survive and to continue to evolve.

## Science and Religion

This is the scientific thinking of the future, and already it is revolutionizing the relationship between science and religion. This is going to make an enormous difference to any genuine search for God today and tomorrow. Suddenly, from being an obstacle, science has become an aid, a kind of springboard into spirituality and mysticism. This is not because science can *prove* anything about God or faith. Rather, science has now recognized its own limitations. Today it is the scientists who are saying: “We don’t know and for the most part we can never know. It is a mystery.”

On the other hand, religion, spirituality, and mysticism will also be revolutionized by this new scientific mentality. For example, there is only one world, one universe. It is no longer possible to think of God, the human soul, and other spirits as inhabitants of another world. Moreover, the universe is one interconnected whole. We are not separate and independent parts. There is an unimaginable number of diverse species and systems, but together they form one whole. And, most important of all, we humans are not in control of the universe.

## The Signs in Summary

Looking at the signs as a whole and together, I am reminded of the famous quote from Charles Dickens’ *A Tale of Two Cities*: “It was the best of times, it was the worst of times.” The signs of our times are strikingly ambiguous and confusing. We have moved into an age that is full of promise but fraught with unimaginable dangers. Nor are we all in the same place. Some have moved far forward, others are moving backwards, and still others have no idea where they are going—which makes it very difficult to sum up where we are as a human family at this moment in our evolution. A metaphor may help.

We are like a giant ocean liner that has come loose from its moorings and is drifting out to sea. The dangers ahead are incalculable. Are we heading for shipwreck and extinction? Some want to return to the safety of the harbor, but that is no longer possible. Others are so distracted that they are not aware of the fact that we are drifting. Still others would like to jump ship and swim to the shore alone. But we are now too far out and there is no longer any possibility of going it alone. We are all in this boat together.

On the other hand, a growing number of passengers view this drifting out to sea as a unprecedented opportunity to move away from the slavery and suffering of the past, to search for the promised land of freedom and happiness. New possibilities are opening up on the horizon every day. The hunger for a new spirituality is hopeful. The desire for justice, peace, and cooperation is encouraging. The new voices from below and the globalization of compassion for those in need are promising. The dangers of individualism are being recognized. And the new science provides us with a map of where we are, where we have come from, and where we might be going.

The dangers and threats remain. The ship is already leaking, and while some are trying to repair the leak, others in their selfish blindness are creating new leaks and ignoring the icebergs ahead of us. There is no storm at sea. Nature is not hostile to us. The storm is on board between the passengers themselves—each blindly pursuing his or her own agenda.

But who is steering this ship? Who is in control? Market forces? The military? The great American Empire? Pure chance? Or God?

It is in this context, at this moment in the evolution of our universe, that we are invited to consider anew and to take seriously the spiritual wisdom of Jesus of Nazareth.