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Introduction

As Woody Allen once put it, "There is no question that there is an unseen world. The problem is how far is it from mid-town and how late is it open?" Since the discoveries of the new physics, the question of the existence of parallel universes--worlds that exist side-by-side along with our own-- has taken on renewed interest well beyond mere speculation.

Today, probably more than in any other day, we are facing a revolution in our thinking about the physical universe-- the stuff that you and I are made of. This revolution, brought to a head by the discoveries of the new physics, including relativity and quantum mechanics, appears to reach well beyond our previous vision, based as it was on the concept of concrete solid reality. The new physics points in a new and more abstract direction--a direction indicating the need to unify our picture of the world.

The major problem in science today is unification-- bringing together a wide disparity of ideas and concepts ranging from the tiniest subatomic matter to the grandest galaxy. Today our knowledge covers a vast spectrum of ideas. And in our attempts to unify those ideas we have discovered great gaps. The science-fictionlike idea that our universe is not alone-- that there exist in some mysterious manner alongside of ours (and this needs some explaining) other universes-- is the latest concept brought forward by the new physicists in their attempt to unify our knowledge. Without the existence of these other worlds, these gaps of knowledge brought into light by the discoveries of the new physics would remain unbridgeable-- incapable of being solved by previous thinking.

When premodern scientific thought about the universe first began with such giants as Kepler, Galileo, Copernicus, and Newton, the universe was imagined to be a gigantic clockwork, with each hand of that clock tipped with a spot

marking each planet circling in the heavens around the sun. Light traveled at infinite or near infinite speed, making every conscious event back here on terra firma always and forever eternally now throughout the infinite universe. Five o'clock in Manhattan was also five o'clock on Saturn and on the nearest star. While durations were measurable with clocks, time itself was eternal and unmeasurable. It was infinite and unimaginable. No one could imagine that time here and time there could have any other relation to each other than the solitary moment of now.

And the universe was imagined to be infinite in all directions. There simply was no measure for it. There was no end to space, and to try to think about infinite space was hopeless, a game for fools and poets.

Matter played its game of following exact rules of inertia and movement called equations of motion, and nothing in principle was undetermined or, for that matter, left for the imagination. All the universe was a giant machine ticking off throughout all eternity and occupying every corner of an infinite space. Such was our thinking prior to A.D. 1900.

With the twentieth century, ideas of Einstein and the revolution of scientific thinking brought forward by the theories of relativity, much of premodern thinking was changed. Some of the gaps were closed. Space was not as infinite as we had

previously thought. It didn't necessarily extend forever, infinite in all directions. Neither was time as inscrutable as thought earlier. Instead time and space joined together and the two became a new concept called spacetime. Events were not eternally now. For example, two events occurring at different locations could be witnessed by an observer standing in the middle as taking place at the same time. These same events would not be simultaneous for a moving observer. If the observer happened to be moving towards the location of the event on his right, away from the event on his left, he would see the "right" event occurring before the "left" one. And, conversely, if he happened to be moving towards the "left" event, away from the "right" one, he would observe the "left" event occurring earlier than the "right."

Matter was also thought of in a new light. It was produced by the universe itself as a knot in the fabric of spacetime. It bent space and it curved time. Naturally this changed our vision of the universe's eternality and made it possible to envision just how the universe could have begun. The finite speed of light and the concept of spacetime made it possible to question just what could have occurred when time itself was now imagined to begin, and all space in the universe was imagined to be smaller than the period at the end of this sentence.

However, even with relativity theory, gaps in our knowledge concerning matter and spacetime still exist. Our present models of the beginning of time, called cosmological theories, still carry a Newtonian mechanical tinge. They still ring of clockworks, and questions about what happened before the big bang--the so-called beginning of everything--paradoxically ring in our heads. And the present models still are grappling with how to bring quantum physics into the beginning of space, time, and matter.

With the discovery of quantum physics--the physics that governs the behavior of atomic and subatomic matter-- more gaps in our knowledge were filled. Matter was seen in a very different light. Its properties depended on how it was observed. Thus the actions of observation play a role in the atomic world that was completely unsuspected by the premodern scientists. That role is now suspected to affect even macroscopic matter in subtle ways that could change cosmology and indeed our concept of just what a universe is.

The major problem of bringing together quantum physics and relativity is still with us. We don't know how to do it. We do know that whatever theory that manages it will be quite bizarre for those who still wish a clockwork universe. In this book we will explore one of the most bizarre and promising theories to come from the minds and imagination of today's physicists: that there must be other universes beside our own.

Parallel universe theory began with physicists in the hectic period of the 1950s and 1960s. It appeared as a new way to make concrete and rational some of the bizarre findings of quantum physics and general relativity. These findings aren't comprehensible without a new vision of reality. Instead they appear as problems. Nothing in our previous thinking about the physical world will make these problems go away.

In other words, the existence of parallel universes resolves some old and not too easily solvable paradoxes. However, as you will see soon enough, it introduces a new and apparently paradoxical way of thinking. In essence, parallel universe theory posits the existence of worlds within our technologically extended senses that must connect or relate with our own.

What is a parallel universe? Like an everyday universe it is a region of space and time containing matter, galaxies, stars, planets, and living beings. In other words, a parallel universe is similar and possibly even a duplicate of our own universe. Not only in a parallel universe must there be other human beings, but these may be human beings who are exact duplicates of ourselves and who are connected to ourselves through mechanisms explainable only by using quantum physics concepts.

To see why scientists are now considering parallel universes seriously as a solution to problems in the wide spectrum of thought including modern physics and cosmology we need to explore some new and exciting ideas. Hope of reconciling the ideas contained within this broad spectrum of human knowledge resides in the existence of these other universes--universes that exist side-by-side with our own and even perhaps occupying the same space as our own in some ghostly manner. This spectrum includes quantum physics, unification of new ideas about the universe, relativity, cosmology, a new notion of time, and psychology--or the effects of the human mind on all of this. Consequently, I have divided this book into six parts, each part relating to one of the above. The second part deals with how parallel universes unify our knowledge, and the fifth part deals with how the existence of parallel universes changes our notion of time. Let me

comment briefly about the other four parts of the book.

Quantum Physics: Bringing in an Observer

Quantum physics deals with a vast arena of physical phenomena, from subatomic, atomic, molecular, all the way up to modern computer elements such as Josephson junctions, which show quantum behavior on a time and space scale well within the world of human perception. Quantum physics also indicates a new effect the effect that an observer has upon a physical system. This effect cannot be objectively understood without the existence of parallel universes.

Relativity: Relationships--Weird and Wonderful

Relativity, including both the special and the general theories, deals with the relationships between matter, energy, space, and time. It includes many weird and wonderful conceptual ideas, such as gravity being the bending of time and light particles (photons) traveling across the universe without spending any time on their own or going anywhere as viewed from their point of view. A careful look at these classical but non-Newtonian theories indicates that our universe must contain regions of matter that strongly distort the spacetime surrounding them. These regions, called black holes, were at first suspected to contain places where the laws of physics would no longer hold. Now we believe that the laws of physics hold everywhere. Consequently these singular regions turn out to be mappable and turn out to be topological holes leading to parallel universes.

Cosmology: A Search for the Beginning

Cosmology deals with the theory of the early universe--how all the universes began about 15 billion years ago. This theory has gone through a number of important changes. We now realize that earlier theories of cosmology must be wrong because they fail to include quantum physics in their deliberations. By including quantum physics, we find strong evidence for the existence of parallel universes.

Psychology: Consciousness and Machine Intelligence

Psychology deals with human consciousness and with problems associated with human behavior and the nature of observation. The parallel universe hypothesis enriches the field of psychology. For example, it may help us to understand major disorders, now appearing rampant in our society, such as multiple personality and schizophrenia. I will show how parallel universe theory explains some of the problems dealing with these syndromes.

Psychology also deals with machine intelligence. This book will look into the possibility that parallel universe theory promises a new kind of quantum computer--one that could not exist if parallel universes were not real. This new computer would exhibit the type of intelligence that present-day computers only mimic. Such an intelligence could make the kinds of decisions that we ourselves seem to enjoy. These decisions would be based both on data arising in the past and on data based on the future. In fact, it is my view that parallel universe theory shows that the future can influence the present just as much as the past.

Parallel Universes and Communication with the Future

The fact that the future may play a role in the present is a new prediction of the mathematical laws of quantum physics. If interpreted literally, the mathematical formulas indicate not only how the future enters our present but also how our minds may be able to "sense" the presence of parallel universes .

Are we pressing the mathematical laws of physics too far? "As far as the laws of mathematics refer to reality, they are not certain; and so far as they are certain, they do not refer to reality," wrote Albert Einstein. Einstein was undoubtedly referring to the mathematical laws of quantum physics in that these laws describe only possibilities of reality but never reality itself. Can mathematics describe reality? I believe that the answer is yes, provided we take the new view given us by parallel universe theory. The laboratory of parallel universe experimentation may not lie in a mechanical time machine, a la Jules Verne, but could exist between our ears.

If the parallel universes of relativity are the same as those of quantum theory the possibility exists that parallel universes

may be extremely close to us, perhaps only atomic dimensions away but perhaps in a higher dimension of space --an extension into what physicists call superspace. Modern neuroscience, through the study of altered states of awareness, schizophrenia, and lucid dreaming, could be indicating the closeness of parallel worlds to our own.

It is in the hope that these radically new and, I believe, quite exciting ideas will turn out to be evidences of truth that I have written *Parallel Universes: The Search for other Worlds*.
