Overview

The author is a physicist and discusses his theories on time. There is a conflict between Einstein's general relativity and modern quantum mechanics, and the concept of time is at the heart of this battle. If time is part of an eternal four-dimensional block of spacetime, then nothing can truly change. The author discusses how a "cosmic evolution" could select different laws of physics by spawning new universes over time. He gives several other theoretical examples of how time is "real", our universe is constantly flowing along in time, and how even the laws of physics can evolve.

Introduction

Classical Newtonian physics says that the future always evolves from the present, in a clear cause-and-effect manner; therefore, the future would be fully predictable with enough knowledge. However, this provides no opportunity for surprise or true novelty.

The current laws of physics explain a part of the whole: either a cell, a planet, or even a galaxy. However, this implies that the clocks used to measure time are outside this universe. But what if there are no set, static universal laws "outside" of time?

In the author's other book The Life of the Cosmos, he conjectures that mini-universes may be borne inside black holes. If this were true, each mini-universe would contain its own set of laws, and a form of "cosmic evolution" would choose the best laws over time. *"A vast space of possible laws. I called this the landscape of theories."* In such a situation, there is not necessarily a controlling entity picking the laws of physics (whether divine or mathematical); novel laws may arise.

By connecting space and time, Einstein showed how information is only considered "real" in relation to other information. Even our "elementary particles" and their masses are only defined as interactions with other particles (primarily the Higgs particle). Time, however, may be the only "real" concept.

PART 1. WEIGHT: THE EXPULSION OF TIME

Chapter 1. Falling

Galileo noticed that everything falls in the shape of a parabola. This is the first example of a timeless law of physics. Mathematical objects (such as the parabola) are purely abstract thoughts; some believe that such mathematical concepts *"somehow illuminate reality"*, that no matter what goes on in the universe, π is always the same. The underlying concept we tend to subconsciously assume is that mathematics transcend time. Plato was the first ancient philosopher to discuss the idea of a divine mathematical reality containing truly timeless truths. Even modern philosophers say that "1+1=2" is a timeless intuitive principle.

We desperately want to believe in a transcendent realm beyond the decaying effects of time. It is appealing and mystical because it means that there's some piece of the universe beyond the reach of time, and therefore beyond the reach of death.

Chapter 2. The Disappearance of Time

For the ancients, the earthly realm had life and decay, and the heavens were divine, beautiful, and timeless. Mathematics was able to describe the divine motion of the heavenly bodies and therefore was considered timeless. In addition, music can also to be described mathematically, and so was considered timeless as well. Even *"Galileo looked for mathematical harmony in everyday motions"* such as the pendulum swinging.

Newton realized that gravity affected falling, but the same phenomenon also caused orbits (orbiting is just perpetual falling)! He invented a new mathematics (calculus) to describe gravity. It was fascinating that both the heavens and Earth were described by simple mathematical laws. Such concepts made the Earth seem much more divine, since it was apparently also guided by timeless mathematical principles.