

Edward Fredkin
CMU West (USA)
digitalphilosophy.org
A Computing Architecture for Physics

Two future problems for programmers are Artificial Intelligence and Physics. In both cases there are ultimate goals: for AI it is human level intelligence and beyond, for Physics it is programming the TOE (Theory of Everything). Of course, if and when we have an AI system far more intelligent than anyone we can let it solve the remaining programming problems. The reason AI research has proved so difficult is because we don't yet know how to program AI. It's also true that our understanding of physics is far from complete. We assume, rightly or wrongly, that the only reason we cannot program a perfect model of fundamental processes in physics is that we don't yet understand the physics. However we may also be in need of new computing paradigms. We want to believe that there is no magic in physics, just things we don't yet understand. Our ignorance mustn't discourage us from trying to make progress. This paper is a report on one frontier in computation; steps towards inventing computing architectures that might let us understand aspects of fundamental processes in physics.

Five big questions with pretty simple answers

Under the roof of one controversial assumption about physics, we discuss five big questions that can be addressed using concepts from a modern understanding of digital informational processes. The assumption is called finite nature. The digital mechanics model is obtained by applying the assumption to physics. The questions are as follows:

1. What is the origin of spin?
2. Why are there symmetries and CPT (charge conjugation, parity, and time reversal)?
3. What is the origin of length?
4. What does a process model of motion tell us?
5. Can the finite nature assumption account for the efficacy of quantum mechanics?

Digital mechanics predicts that for every continuous symmetry of physics there will be some microscopic process that violates that symmetry. We are, therefore, able to suggest experimental tests of the finite nature hypothesis. Finally, we explain why experimental evidence for such violations might be elusive and hard to recognize.