

Information as Physical Reality: A New Fundamental Principle Proposed by Anton Zeilinger

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Abstract: In 1905 Albert Einstein proposed that the world is not what it seems. He suggested that it is not continuous but atomistic, not absolute but relative, not classical but quantized. In the ensuing century his heuristic hypotheses were confirmed as facts. They define what might be called the “atomic world view.” Today we stand on the threshold of a new era: the information age. Far from replacing the atomic view of the world, the concept of information can be enlisted to build upon our current understanding of nature, and to fill in remaining gaps. We know that atoms are too small to be seen with the unaided eye, and that relativistic speeds are too fast to be perceived. We also know that quantum mechanics, the language of the atom, which replaces the crisp OR of classical physics with an ambiguous AND, really describes the way the world is. (If Schrödinger’s cat were of atomic dimensions, it would be both alive AND dead.) What is still unclear after eighty years of effort is how certainty emerges from uncertainty – how classical physics articulates with quantum physics. The Austrian physicist Anton Zeilinger has proposed a new fundamental principle based on “information” that promises to kill two birds with one stone. It bridges the divide between the classical and the quantized, and at the same time throws light on the question of why the world must be quantized in the first place. Zeilinger’s Principle attempts to lay a firm foundation for quantum physics, in the same way that Einstein’s Atomic Hypothesis, and his Principle of Relativity, anchor our world view.
