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Quantum of Information CASLAV BRUKNER, ANTON ZEILINGER, Institute of Experimental Physics, University of Vienna, Boltzmanngasse 5, 1090 Vienna, Austria — The violation of local realism is today a well established experimental fact. From it follows that either locality or realism or both cannot provide a foundational basis of Nature. Relaxing the locality condition would essentially not change the epistemological structure of classical physics but only extend its limits. Abandonment of reality, however, would require a radical revision of the conceptual background of all our theories so far. Is a novel conceptual basis of quantum theory feasible, in which the impossibility of defining external reality independent and prior to observation naturally emerges? We suggest the finiteness of information content of a quantum system as providing such basis. Any realistic theory that could arrive at an accurate prediction of a particular event would require the system to carry information as to which specific result will be observed for all possible future measurements. Because the system cannot carry more information than is in principle available, there must exist measurements for which individual events contain an element of irreducible randomness. Quantum entanglement arises from the possibility that information in a composite system resides more in the correlations than in properties of individuals. In the talk we will report on recent efforts towards providing derivations of the elements of the Hilbert space structure from the quantization of information.

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