

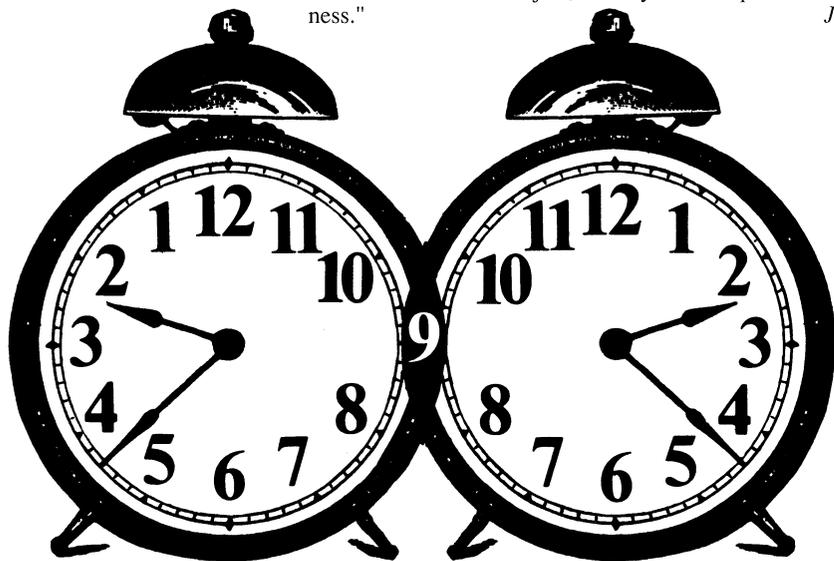
# Pregnant with Insights

H. D. Zeh, University of Heidelberg, FRG

## *The Physical Basis of the Direction of Time*

1989. VIII, 168 pp. 20 figs. Softcover DM 56,-  
ISBN 3-540-50930-5

"I do not know of any questions more pregnant with insights yet to be garnered, nor any book on the subject that makes richer linkage with the literature on the subject, nor any with deeper dedication to soundness."  
*John A. Wheeler*



The physical asymmetry of nature under time reversal is analysed in this essay. The author investigates the most important classes of phenomena that characterize a direction of time: radiation, thermodynamics, quantum phenomena, and the structure of spacetime. Their relations and the search for a cosmological common root of these "arrows of time" and of the traditional concept of causality are discussed. Particular emphasis is placed on quantum indeterminism. It is argued that a common root may be found in the properties of the time-independent wave function of the universe that arises from the quantization of general relativity. This requires that the physical concept of time is reduced to a correlation between physical states, including those characterizing clocks and observers. The description of irreversible phenomena is shown to be fundamentally "observer-related" in a way that can be formalized following Zwanzig. The book is aimed mainly at the student or scientist seeking an overview of the whole issue. Compared to the German version the book has been widely revised and extended.

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H&S 9193/5/1

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