

Preface

The workshop *Decoherence: Theoretical, Experimental, and Conceptual Problems* took place at the Zentrum für interdisziplinäre Forschung (Centre for interdisciplinary research, ZiF) at Bielefeld University (November 10–14, 1998).

The concept of decoherence has attracted much attention during recent years and this workshop was intended to bring together a diverse collection of researchers to exchange new ideas concerning various approaches to current problems.

Decoherence is a quantum-mechanical process that dynamically describes the apparent loss of quantum coherence due to coupling of the system under observation to other degrees of freedom, which escape direct observation. Typical examples are given by scattering processes, in which the off-scattered particles (and/or radiation) are not detected. In such processes quantum correlations between the observed system and its environment become delocalized in an effectively irreversible manner. Such quantum correlations can neither be seen by observations on one or the other system alone, nor interpreted as statistical correlations between existing (i.e., defined, but possibly unknown) states of local systems. They truly reflect the non-local nature of quantum mechanics.

The process of decoherence is of major importance for both theoretical and experimental physics, and has direct implications in close sciences such as chemistry and biology. It is also linked to some fundamental problems, such as that of quantum measurement, observation and related philosophical issues. These topics have been the subject of a long-term study by a group at the interdisciplinary research institute FESt (“Forschungsstätte der Evangelischen Studiengemeinschaft”, Heidelberg), whose aim is to promote interdisciplinary projects and interactions between various fields in natural sciences and the humanities.

The organization of the workshop at ZiF is a consequence of the activity of the above-mentioned study group at FESt and attests for the interest and engagement in interdisciplinary projects at both institutions. Our aim was to provide a platform for a thorough exchange of ideas on all aspects of decoherence. Hence people from different fields were invited and much emphasis was laid on discussions.

We thank all speakers for their work and preparation of their lectures, to the benefit of a most successful meeting. Most of the lectures can be found in the present volume, and we are grateful for the willingness of the speakers to write up their contributions.

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