

Preface

Quantum computers do not exist as of yet, it may take more than a decade until usable devices come to realisation; some people are even doubtful as to whether a large-scale quantum computer is a possibility in principle. However, the basic ideas formulated just a bit more than 10 years ago had a tremendous impact upon research in the special field in particular, and they have initiated substantial progress towards deeper understanding of quantum mechanics in general. Modern experimental techniques have provided convincing evidence about various aspects of “quantum weirdness” in that, for instance, entanglement or teleportation are established as physical realities. Also, the mysterious collapse of the wave function is now replaced by a thorough understanding of the dynamical process which is decoherence.

It is in the spirit and tradition of the South African Chris Engelbrecht Summer School in Theoretical Physics that the topical subject implied in the title of the present issue was chosen as the theme of the School in 2001. This volume presents pertinent contributions of some of the leading researchers at the front of this highly topical field. It comprises material that is well balanced between theoretical aspects and experimental realisation. The broad spreading of contributions in this fast-growing field is expected to ensure, for this volume, a special place in an exploding proliferation of monographs, books and other forms of literature. This volume also reflects nicely the speakers’ endeavour to guide the audience from the beginners level to the present state of the art.

The participants came from a larger variety of backgrounds than ever before at this School owing to the interdisciplinary character of the topic. We are also delighted that a substantial number came from adjacent countries and from further afield. The togetherness and the friendly working atmosphere of speakers and listeners were noted by all participants.

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