

MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

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Entanglement and Decoherence: Mathematics and Physics of Quantum Information and Computation

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ABSTRACT. This is the report for the Oberwolfach workshop on Entanglement and Decoherence: Mathematics and Physics, held January 23 - 29, 2005.

Mathematics Subject Classification (2000): 94Axx.

Introduction by the Organisers

The meeting was attended by over 50 participants from more than 10 countries and three continents.

It brought together mathematicians, physicists and computer scientists working on quantum information and computation. Experts were present as well as young participants, both at predoctoral level as well as postdoctoral level. The focus was on the problems of entanglement and decoherence, aiming at the formulation and discussion of precise concepts, developments of models and their interrelations, and the discussion of experiments in relation with the theory. Special attention was given to recent developments, and to furthering interaction and co-operations between the different groups. The scientific program focused mainly on the following subjects: 1) Quantum Entanglement and Nonlocality: including Bell-type inequalities (theoretical and experimental studies), equivalence of quantum states under local unitary transformations. 2) Quantum Separability: separability criteria for multiple quantum mixed states in arbitrary dimension. 3) Decoherence: study of models; quantum error corrections, fault tolerant computation, multiparticle problems. 4) Sources of Quantum Entanglement. 5) Quantum Information: quantum cloning, teleportation, key distribution, algorithms. 6) Quantum Measurement and Quantum Optics; Holonomic quantum gates; Quantum semigroups;

Continuum Observation. 7) Mathematical Quantum and non commutative structures in connection with quantum information theory.

20 lectures were presented, including 15 surveys and 5 concentrating on specific recent results. There were 10 informal evening lectures on 3 topics: entanglement, control and decoherence. Besides 7 informal talks were presented in 2 round table discussions.

All presentations and discussions amply demonstrated the vitality and actuality of this area of research and the fascinating interrelations between the different specialities it involves. The organizers and participants would like to take this opportunity to thank the Mathematisches Forschungsinstitut Oberwolfach for having provided a comfortable and inspiring environment for the meeting and the scientific work.