Guest Editors' Preface

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Realistic quantum systems designed for quantum information processing (QIP) cannot avoid interactions with their environments, which can alter their quantum coherence and entanglement properties. Environment-induced quantum decoherence provides a way to understand how a quantum system acquires classical behavior. But this very process undermines the effectiveness or even feasibility of QIP and is thus of primary concern in the actual design of quantum computers. Investigation of quantum entanglement is both of practical and theoretical significance: It is viewed as a basic resource for QIP and it is, in the words of *Schroedinger*, the uniquely quantum feature of quantum mechanics. Mastering how entanglement in a quantum system interacting with an environment evolves in time is also of vital importance for QIP as is the relation between decoherence and disentanglement.

Environment-induced decoherence in the context of QIP has been under study for over a decade and investigation of environment-induced disentanglement has seen a rapid increase in recent years. In view of the fast development and confluence of these two subjects of fundamental and practical importance for QIP we think it useful to devote a **special issue to quantum decoherence and entanglement** reflecting the state-of-the-art of this research area by some of the leading experts. The collection of papers in this special issue contains a rather broad spectrum of discussions on theories and issues as well as some description of leading experiments and findings. To limit it to a manageable size there is a slight lean on systems of fewer qubits as in atomic and optical systems and superconductivity over condensed matter and many-body

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systems, the study of the latter merits the dedication of special issues in their own rights. Owing to the fundamental nature of its theme we hope that the papers in this special issue could benefit a wider spectrum of readers beyond these confines.

We thank all the authors for their timely and valuable contributions to this special issue.