

Editorial

Following Peter Shor’s seminal discovery in 1994, of a quantum algorithm for factoring large integers, we have witnessed an explosive growth of research activity in quantum information processing—including quantum computing, quantum communication and quantum cryptography. Diverse communities including computer scientists, mathematicians, theoretical physicists and experimental physicists have become actively involved. The goal of this new journal “Quantum Information and Computation” (QIC) is to bring these communities together by providing a common forum for the dissemination of information in all areas of quantum information processing, including both theoretical and experimental aspects.

The first issues of QIC will contain (among other things) a series of invited review papers on the special topic “Entanglement: theory and experiment”. See the introduction by I. Cirac, R. Jozsa and D. Wineland for more details. QIC will also feature a Web-Corner prepared by P. Kok and in future we look forward to adding perspectives, book reviews, correspondences and tutorials. On behalf of all seven Managing Editors, I would like to take this opportunity to thank our authors, publisher and International Advisory Board members for their generous support. Ultimately the success of QIC will depend on the entire community of researchers in quantum information and computation and we look forward to your support in contributions and subscriptions!

Hoi-Kwong Lo, Coordinator

on behalf of the seven Managing Editors:

Sam Braunstein
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Introduction to the first issue

To launch this new journal we have invited a series of review papers on the subject of entanglement, to appear in the first issues. These papers, treating both theoretical and experimental aspects, are intended to be of broad interest to the wider scientific community working in quantum information.

Apart from its fundamental significance, the phenomenon of entanglement is at the heart of most applications in the field of quantum information. Indeed if we search through the Los Alamos electronic preprint archive – where most works in the field are posted – we find that the word “entanglement” appears 65, 108 and 173 times in the titles for the years 1998, 1999 and 2000 respectively. If we search abstracts we find 105, 205 and 327 papers for these years and about 1000 papers for all years!

One of the reasons why entanglement is continuing to receive so much attention by theoreticians, is that despite its importance, we still do not know how to quantify and even qualify this property in general. This first issue contains four invited review papers describing some efforts in this direction, where spectacular advances have taken place in the last few years. The paper by M. Horodecki, contains an introductory overview of the measures of entanglement that have been proposed so far. W. Wootters gives a comprehensive introduction to one such measure, the entanglement of formation, and the associated concept of concurrence. P. and R. Horodecki describe the process of entanglement distillation, which allows one to obtain pure (and directly useful) entanglement from mixed states. Finally, M. Nielsen and G. Vidal review how pure entangled states can be transformed into each other. We remark that the next issue will include invited papers on “Entanglement: Experiments”. For a complete listing, see the List of Forthcoming Papers.

We would like to thank the authors for their efforts in writing thorough, but also accessible, reviews. We expect that their contributions will be important references of lasting value in the field. We also hope that these papers will serve as a guide to establish the quality of this journal in the future.

Ignacio Cirac, Richard Jozsa and David Wineland