

## EDITORIAL

This Special Issue of *Quantum Information and Computation* contains a selection of the submitted papers from the ERATO Workshop on Quantum Information Science, held in Tokyo during September 5–8, 2002. The meeting was part of Japan’s ERATO (Exploratory Research for Advanced Technology) Quantum Computation and Information Project.

The papers can be classified into four subject areas within quantum information: information compression, multipartite entanglement, physical information processing devices, and the behavior of quantum analogues of random walks.

Data compression plays a fundamental role in both the theory of classical information and as well as in existing mechanisms for the storage and transmission of information. In 1995, Schumacher demonstrated that there are quantum analogues to some classical compression schemes. The article “Simple construction of variable-length source coding”, by Hayashi and Matsumoto, shows how to construct such a scheme in scenarios where the entropy of the source is not known *a priori*.

Quantum entanglement can be thought of as the quantum analogue of stochastic correlation—yet it has many intriguing properties that have no classical counterpart and is a lively subject of investigation. Entanglement can occur in a variety of different ways. Multipartite entanglement (between more than two systems) has to date been more difficult to classify than bipartite entanglement. The articles “Entangled graphs”, by Plesch and Bužek, and “Multipartite entanglement and hyperdeterminants”, by Mikaye and Wadatani, address various ways of classifying multipartite entangled states.

In order to realize the potential of quantum information processing, it is important to connect the abstract theory with actual physical devices. The articles “A simulated photon number detector in quantum information processing”, by Nemoto and Braunstein, and “Optimal holomorphic quantum gates”, by Niskanen, Hakahara, and Salomaa, explore physical mechanisms for quantum computation and communication.

Finally, since classical random walks are useful processes in a number of classical algorithms, it is natural to investigate the quantum analogues of them and their properties. The article “Limit theorems and absorption problems for quantum random walks in one dimension”, by Konno, contributes to this investigation.

I would like to thank the organizers of the ERATO workshop and the referees of these papers for their careful and timely reviews.

**Richard Cleve**