

QPL 2006

**Proceedings of the
4th International Workshop on
Quantum Programming Languages**
(Preliminary Version)

July 17–19, 2006
Oxford

Peter Selinger, Editor

Preface

This volume contains the proceedings of the 4th International Workshop on Quantum Programming Languages (QPL 2006), which will be held July 17–19, 2006 in Oxford. The workshop is held as part of the week-long event “Cats, Kets and Cloisters”, which will also include three other workshops on related topics.

The purpose of the QPL workshop series is to bring together researchers working on mathematical foundations and programming languages for quantum computing. In the last few years, there has been a growing interest in logical tools, languages, and semantical methods for analyzing quantum computation. These foundational approaches complement the more mainstream research in quantum computation which emphasizes algorithms and complexity theory. Previous workshops in this series were held in Ottawa, Canada (2003), Turku, Finland (2004), and Chicago, U.S.A. (2005).

The following list of topics is typical of the scope of this workshop series, although not necessarily exhaustive:

- the design and semantics of quantum programming languages
- new paradigms for quantum programming
- specification of quantum algorithms
- higher-order quantum computation
- quantum data types
- reversible computation
- axiomatic approaches to quantum computation
- abstract models for quantum computation
- properties of quantum computing resources and primitives
- concurrent and distributed quantum computation
- compilation of quantum programs
- semantically methods in quantum information theory
- categorical models for quantum computation

The workshop will include a day of five invited tutorials by three speakers, as well as ten contributed papers that appear in this volume. The tutorials are:

- Sam Lomonaco Jr. (UMBC, Maryland): “*A Rosetta stone for quantum computing and information science: cats, kets, cloisters, measurement, and quantlement*”
- Sam Lomonaco Jr. (UMBC, Maryland): “*Introduction to quantum algorithms*”
- Sam Lomonaco Jr. (UMBC, Maryland): “*Topological quantum computing and the Jones polynomial*”
- Samson Abramsky (Oxford): “*Introduction to logics as type theories for quantum processes*”
- Simon Gay (Glasgow): “*Introduction to Semantics of Programming Languages*”

The contributed papers were selected by a program committee consisting of Samson Abramsky (Oxford), Bob Coecke (Oxford), Simon Gay (Glasgow), Philippe

Jorrand (Grenoble), Prakash Panangaden (McGill), and Peter Selinger (Dalhousie).

This workshop, as part of the “Cats, Kets, and Cloisters” event, enjoys partial support from the EPSRC Network on Semantics of Quantum Computation (EP/E006833/1, EP/E00623X/1), which provides funding for two QPL tutorials and supports attendance of some research students. There is also support from EPSRC Advanced Fellowship on The Structure of Quantum Information and its Applications to IT (EP/D072786/1).

Special thanks are due to Bob Coecke and the other local organizers, for their care in arranging this workshop and “Cats, Kets and Cloisters”. The organizing team consists of: Samson Abramsky, Dmitri Akatov, Dan Browne, Bob Coecke, Ross Duncan, Bill Edwards, Lee Momtahan, Eric Oliver Paquette, Hilary Priestley, Isar Stubbe, Mehrnoosh Sadrzadeh, Nikos Tzevelekos, and Frank Valckenborgh.

Halifax, July 2006
Peter Selinger

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