Fondation Philippe Wiener - Maurice Anspach
Department of Computer Science - University of Oxford

# PHILIPPE WIENER LECTURE IN OXFORD

## Prof. Serge Massar

Quantum Information Laboratory
Université libre de Bruxelles

# CERTIFIED QUANTUM RANDOMNESS

**Tuesday 8th November, 4 pm**
Lecture Theatre B
Department of Computer Science
Wolfson Building, Parks Road - OX1 3QD

The lecture will be followed by a reception
More information: fwa.ulb.ac.be

ULB FONDATION WIENER-ANSPACH UNIVERSITY OF OXFORD

Fondation Philippe Wiener - Maurice Anspach
Department of Computer Science - University of Oxford

# PHILIPPE WIENER LECTURE IN OXFORD


## Abstract

Randomness is a phenomenon which we are confronted with all the time. Will it rain today? Will the train be on time? What present will I receive at Christmas? But are such phenomena truly random?

Good randomness is essential for many applications. For instance, cryptography, the art of hiding information from malicious parties, is only as good as the sources of randomness that underlie it.

Quantum mechanics, the theory of microscopic phenomena, can only predict the probability of events. For instance quantum theory can only predict the probability that a radioactive nucleus will decay, not when the nucleus will decay. Does this mean that microscopic phenomena are truly random?

By studying systems of two entangled particles, it can be shown both theoretically and experimentally, that events at the microscopic scale are truly random, truly unpredictable. Beyond its philosophical implications, this result also has important potential applications. Indeed it implies that one can build random number generators that certify that they work correctly. That is, if the random number generator malfunctions in some way, if the numbers it produces cease to be random, this will automatically be detected. By extending this idea, one could also build quantum cryptographic systems and quantum computers that certify that they work correctly.


## Biographical note

**Serge Massar** was born in Zambia in 1970 and spent most of his youth in Africa. He graduated in physics from the Université Libre de Bruxelles (ULB) in 1991 with highest honours. He defended his PhD at ULB in 1995 with highest honours. From 1995 to 1997 he was a post-doctoral researcher at Tel Aviv University (Israel), and then from 1997 to 1998 at Utrecht University (Netherlands). In 1998 Serge Massar came back to the Université Libre de Bruxelles as a Research Associate (Chercheur Qualifié) of the Fonds National de la Recherche Scientifique (FNRS-FRS). In 2012 he joined the faculy staff at ULB. Since 2004 he directs the Laboratoire d'Information Quantique at ULB. His research interests include quantum gravity, quantum information and the foundations of quantum mechanics, experimental optics, artificial intelligence. Serge Massar was awarded the Alcatel-Bell prize of the FNRS, the 2010 La Recherche prize, and won the STOC2012 best paper award. He has co-authored more than 120 publications in peer reviewed scientific journals, more than 60 conference proceedings, and holds 2 patents.

ULB

FONDATION WIENER-ANSPACH

UNIVERSITY OF OXFORD