ImPACT Yamamoto Program

Lecture Series

Profs. Peter Drummond and Hideo Mabuchi

November 9-11, 2016 / 10:30～12:00 & 13:30～15:00
JST Tokyo Headquarters (K's Gobancho)

November 9 (wed)	**Meeting Room A, 9th Floor**
10:30～12:00	"Coherent feedback quantum control and autonomous quantum circuits" **Prof. Hideo Mabuchi**
13:30～15:00	"Theory of phase-space representations: Wigner, positive-P" **Prof. Peter Drummond**

November 10 (thus)	**Meeting Room A-2, 2nd Floor**
10:30～12:00	"Simulating the early universe: metastable vacua" **Prof. Peter Drummond**
13:30～15:00	"The SLH formalism and a limit theorem for quantum stochastic differential equations" **Prof. Hideo Mabuchi**

November 11 (fri)	**Meeting Room A, 9th Floor**
10:30～12:00	"Classical recursive filtering and quantum trajectory theory" **Prof. Hideo Mabuchi**
13:30～15:00	"Boson sampling and X-Y quantum computers" **Prof. Peter Drummond**

Distinguished Professor Peter Drummond

Professor and Science Director, Centre for Quantum and Optical Science, Swinburne University of Technology
PhD, Waikato University, New Zealand; A.M., Harvard University, United States; B. Sc (Hons), Auckland University, New Zealand
http://www.swinburne.edu.au/science-engineering-technology/staff/profile/index.php?id=pdrummond

Biography
Professor Drummond was educated at Auckland and Waikato University in New Zealand, and at Harvard University in the USA. He has worked as an academic at Auckland and Queensland Universities, and as a researcher at Rochester University. He has been a visiting scientist at IBM Research Laboratories (USA), and NTT Basic Research Laboratories (Japan), as well as a visiting professor at Waikato University (NZ), Erlangen University and Heidelberg University (Germany), and Ecole Normale Superieure (France). He is currently University Distinguished Professor and Science Director of the Center for Quantum and Optical Science at Swinburne University of Technology, as well as Australian representative on the IUPAP Commission for Atomic and Molecular Physics.

Outline
Lecture 1: Theory of phase-space representations: Wigner, positive-P
1) Characteristic functions
2) Operator ordering
3) Existence theorems
4) Observables and operator mappings
5) Positivity
6) Stochastic equations

Lecture 2: Simulating the early universe: metastable vacua
1) Quantum fields in the early universe
2) Observations: what we know from Planck
3) Early universe quantum computer using BEC
4) Tests with Rubidium BEC: quantum interferometry
5) Proposed experiments: simulating unstable quantum vacua
6) Metastable quantum vacua: quantum tunneling predictions

Lecture 3: Boson sampling and X-Y quantum computers
1) Boson Sampling quantum computers
2) Calculations using complex-P methods: analytic scaling
3) Complex-P simulations: channel grouping and interferometry
4) X-Y quantum computers
5) Positive-P methods: mapping parametric to X-Y
6) Solving geometrically frustrated kagome ground states

Professor Hideo Mabuchi

Stanford University: Department of Applied Physics: Professor and Chair
https://minty2.stanford.edu/wp/

Biography

I received my A.B. in Physics from Princeton University (1992) and my Ph.D. in Physics from the California Institute of Technology (1998). I spent nine years as a faculty member at Caltech with appointments in Physics and in Control & Dynamical Systems, then moved to Stanford University as Professor of Applied Physics in 2007. I have been serving as Chair of the Applied Physics Department since September 2010. Selected honors include an A.P. Sloan Foundation Research Fellowship, an ONR Young Investigator Award, a Fellowship from the John D. and Catherine T. MacArthur Foundation, and the inaugural Mohammed Dahleh Distinguished Lectureship awarded by UCSB.

Abstract

Lecture 1: Coherent feedback quantum control and autonomous quantum circuits – An overview of the importance of feedback techniques in circuit design together with some theoretical studies of coherent feedback in networks of open quantum systems for classical and quantum information processing.

Lecture 2: The SLH formalism and a limit theorem for Quantum Stochastic Differential Equations – An overview of the SLH formalism used in quantum circuit/network theory as well as a rigorous limit theorem for "adiabatic elimination" of fast dynamics; this lecture provides details of modeling techniques used for the examples in Lecture 1.

Lecture 3: Classical recursive filtering and quantum trajectory theory – Connections of open quantum system theory with quantum measurement theory and classical recursive filtering; this lecture explains the concept of recursive filtering with a classical harmonic oscillator example and draws connections to correct interpretation of quantum trajectories and noise terms in stochastic Schrodinger/Master equations.