Contribution ID: **291** Type: **Poster Presentation**

The Stochastic Schroedinger Equations Approach to Open Quantum Systems

Wednesday, 9 July 2014 17:10 (1h 50m)

Abstract content
   (Max 300 words)
Formatting &
Special chars

A first aim of the theory of open quantum systems is the description of the time evolution of a quantum system S (the open system) interacting with an external environment E. To describe the partial dynamics of such an open system one can use the master equation for the reduced density matrix $\rho(t)$. Usually, the master equation is derived with the help of the Markov approximation. This approximation fails when the memory effects can not be ignored, i. e. for strong coupling, correlations, and entanglement in the initial S-E state and at low temperature. Several different approaches have been proposed to describe this non-Markovia dynamics.
In both situations (Markovian and non-Markovian) a useful approach to describe concrete physical evolutions is provided by the theory of the stochastic Schroedinger equation (SSE). A SSE is a stochastic differential equation for a wave-function process $\psi(t)$. In this situation, the residual effects of the system-bath interaction are reflected in stochastic terms. The link with the traditional master equation is given by the average property $E[|\psi(t)><\psi(t)|] = \rho(t)$, where E denotes the average over the realizations of $\psi(t)$. SSEs find wide application in quantum optics, i.e for the description of photo-detection or heterodyne/homodyne detection. These kind of equations can be simulated numerically with the help of the Monte-Carlo wave function method.
In this work [1] we describe how to introduce memory effects in the stochastic Schroedinger equation via coloured noise. Specifically, the approach is illustrated by using the Ornstein-Uhlenbeck process as colored noise and simulations of the non-Markovian process are shown. Finally, an analytical approximation technique is tested with the help of the stochastic simulation of a dissipative qubit.

[1] I. Semina, V. Semin, F. Petruccione, A. Barchielli , OSID, 21, 1440008 (2014).

Apply to be
 considered for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD)?

PhD

Main supervisor (name and email)
and his / her institution

Francesco Petruccione, <francesco.petruccione@gmail.com>, University of KwaZulu-Natal

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

Yes

Primary author: Mrs SEMINA, Iuliia (University of KwaZulu-Natal)

Co-authors: Prof. BARCHIELLI, Alberto (Politecnico di Milano); Prof. PETRUCCIONE, Francesco (UKZN); Dr SEMIN, Vitalii (University of KwaZulu-Natal)

Presenter: Mrs SEMINA, Iuliia (University of KwaZulu-Natal)

Session Classification: Poster2

Track Classification: Track G - Theoretical and Computational Physics