PHOTONICS - EUROPHOTONICS MASTER COURSE

<u>MASTER THESIS PROPOSAL</u>

Course 2014 –2015

Laboratory : ICFO - Quantum Optics
City, Country : Castelldefels, Spain

Title of the master thesis : Large-scale classical simulations of quantum systems using the Trotter-Suzuki decomposition

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Summary of the subject (maximum 1 page):

The Trotter-Suzuki approximation leads to an efficient algorithm for simulating the time-dependent Schrödinger equation [1-2]. An implementation has been developed that scales to massively parallel computing clusters that include many-core central processing units and also general-purpose graphics processing units [3], but applications have been lacking. Systems of interest that can be simulated include Bose-Einstein condensates, quantum holography, and spin glasses. The proposed project would extend the implementation to these systems of interest, calculate the ground state energy with negative time evolution, and study the subsequent dynamics to understand phase transitions and other important physical qualities of the systems.

[1] Trotter, H. (1959) Proceedings of the American Mathematical Society **10**, 545–551.
[2] Suzuki, M. (1990) Physics Letters A **146(6)**, 319–323.
[3] Wittek, P. & Cucchietti, F. (2013) Computer Physics Communications **184**, 1165–1171.

Keywords :

Additional information :
* Amount of the monthly allowance (if it is the case):
* Required skills: C++ programming
* Miscellaneous: