

Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars 2010)

Proposition de stage pour l'année 2009-2010 (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / internship supervisor:			
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Code d'identification :	Organisme : University of Virginia		
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Adresse / address:	382 McCormick Road, Charlottesville, VA 22904-4714, USA		
Lieu du stage / internship place:	Quantum Fields and Quantum Information group		

Titre du stage / internship title: Quantum computing over the optical frequency comb
Résumé / summary Quantum computing offers the revolutionary promise of exponential speedup for classically intractable quantum calculations [1] and integer factoring [2]. Its realistic experimental implementation requires multipartite nonlocal quantum correlations (entanglement) and faces two daunting challenges: decoherence and scalability. We are engaged in the implementation of massively scalable entanglement in the optical frequency comb (OFC) defined by the eigenmodes of the optical cavity of an optical parametric oscillator (OPO). In an OPO, continuous-variable (CV) entanglement [3] can be generated by way of quantum squeezing interactions. Our group has achieved generation of squeezed and CV entangled states for precision measurements [4-6]. In a recent study [7,8], we showed that feasible [9] nonlinear media can entangle the OFC into a CV cluster state, suitable for universal one-way quantum computing [10] if non-Gaussian Wigner functions are used [11]. We are now actively recruiting motivated and talented Ph.D. students to work on the experimental demonstration of large-scale CV entangled systems (tens of "qumodes") in OPOs and their characterization toward possible future tests of quantum theory. Work is, primarily, experimental quantum optics in the continuous-wave regime. A strong interest in understanding the theoretical underpinnings is a definite plus. [1] R.P. Feynman, Int. J. Theor. Phys., 21:467-488, 1982. [2] P.W. Shor, Proc. 35th Annual Symposium on Foundations of Computer Science, p. 124, 1994. [3] S.L. Braunstein and P. van Loock, Rev. Mod. Phys., 77(2):513, 2005. [4] S. Feng and O. Pfister, Phys. Rev. Lett., 92:203601, 2004. [5] S. Feng and O. Pfister, Opt. Lett., 29:2800, 2004. [6] J. Jing, S. Feng, R. Bloomer, and O. Pfister, Phys. Rev. A, 74:041804(R), 2006. [7] N.C. Menicucci, S.T. Flammia, and O. Pfister, Phys. Rev. Lett., 101:130501, 2008. [8] S.T. Flammia, N.C. Menicucci, and O. Pfister, J. Phys. B, 42:114009, 2009. [9] R.C. Pooser and O. Pfister, Opt. Lett., 30:2635, 2005. [10] R. Raussendorf and H. J. Briegel, Phys. Rev. Lett., 86:5188, 2001. [11] N.C. Menicucci, et al., Phys. Rev. Lett., 97:110501, 2006.
Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : YES!
Si oui, financement de thèse envisagé/ financial support for the PhD: ABSOLUTELY! (from NSF or DoD research grants)

Lasers et matière	X	Lumière, Matière : Mesures Extrêmes	X
Optique de la science à la technologie	X	Physique des plasmas	

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