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WEEKLY CALENDAR

September 22, 2008

Department Colloquium

"Quantum Computer Over the Rainbow"

3:40 PM, September 25, 2008
109 Nicholson Hall

Olivier Pfister
University of Virginia
Host: Jonathan Dowling

• Refreshments served at 3:15 PM in 201 Nicholson Hall •

Quantum computing has attracted much attention over the past sesquidecade because it makes integer-factoring easy, even though that has been a historically (if not provably) hard mathematical problem. The physical implementation of nontrivial quantum computing is an exciting, if daunting, experimental challenge, epitomized by the issues of decoherence and scalability of the quantum registers and processors. The core experimental problem can be summarily stated as akin to the creation of a Schrödinger cat: a macroscopic (or at least mesoscopic) amount of elementary systems ("cells") in a nonfactorable (entangled) quantum superposition of two orthogonal states ("all alive" and/or "all dead"). In this talk, I will present a novel scheme for realizing an entangled state, of potentially very large size, in a remarkably compact physical system: the optical frequency comb (OFC) defined by the eigenmodes of an optical resonator. The OFC is a naturally large set of exquisitely well defined oscillators, such as in the femtosecond, carrier-envelope-phase- and mode-locked lasers which have redefined time/frequency metrology and ultraprecise measurements in recent years. High coherence can therefore be expected in the quantum version of the frequency comb. Recently, we have shown theoretically that the nonlinear optical medium of a single optical parametric oscillator (OPO) can be engineered, in a sophisticated but already demonstrated manner, so as to entangle, in constant time, the modes of the OPO's frequency comb into an entangled state of arbitrary size, suitable for one-way quantum computing over continuous variables. I will describe the mathematical proof of this result and report on our progress towards its experimental implementation.

Welcome To:

Dimitrios Galanakis, a Postdoctoral Researcher with Dr. Juana Moreno. He is located in Room 211-D, 578-0587.

Shiquan Su, a Postdoctoral Researcher with Dr. Juana Moreno. He is located in Room 211-A, 578-0814.

Unjong Yu, a Postdoctoral Researcher with Dr. Juana Moreno. He is located in Room 211-D, 578-0587.

Publications:

"Strong violations of Bell-type inequalities for Werner-like states," Christoph F. Wildfeuer and Jonathan P. Dowling, Physical Review A (Vol.78, No.3, Art. No. 032113).