EE599: Introduction to Quantum Error Correction

Instructor: Daniel Lidar (lidar@usc.edu, 213-740-0198, SSC-609)
Grader: Soraya Taghavi (taghavi@usc.edu, SSC-607)
Location: VHE-206
Time: Th 3:30-5:30
Term: Spring 2007
Office Hours: None, but e-mail me to set up a time to talk with me
Textbook: *Introduction to Quantum Computation* by M. Nielsen and I. Chuang
Course web page: Available on blackboard.usc.edu

Syllabus

- **Review of open quantum systems:** Density matrix, the Kraus representation, master equations, decoherence
- **Quantum error avoidance:** Decoherence-free subspaces and subsystems
- **Quantum error suppression:** "Bang-bang" control, dynamical decoupling
- **Quantum error correcting codes:** The Shor and Steane codes, the general error correction conditions, stabilizer codes
- **Hybrid error correction:** Optimized performance via combinations of error avoidance, suppression, and correction
- **Quantum computation over encoded qubits:** Universal sets of gates, universal Hamiltonians
- **Fault tolerance:** Concatenated codes, the threshold theorem

Grading

- 40%: Problem sets
- 50%: Final paper/project
- 10%: Scribe notes

Problem sets will be assigned once every two weeks.

The final project should involve reading two or three research papers on additional topics beyond those covered in the course, and writing up a digested version of them, ideally with a small extension of the results.

One student each lecture will be assigned to take notes and write them up in TeX for distribution to the rest of the class. When you complete the notes (which should be within 2 weeks after the lecture), give the TeX source to me and I will edit it and post the notes on the class web page.