WEEKLY CALENDAR

10 October 2005

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Materials Science & Engineering Seminar

3:40PM / Wednesday, 12 October 2005 / Room E-130 Howe Russell

Host: Dr. Ravi Rau

"New Hope for Nanocrystalline Porous Silicon"

S.C. Agarwal, PhD
Department of Physics, Indian Institute of Technology, Kanpur

Silicon, undoubtedly, is the most favored material for making semiconductor devices. It is, however, an indirect gap material and thus is a poor emitter of light. This severely limits its use in making optoelectronic devices. Nanocrystalline silicon (nc-Si) layers, prepared by the electrochemical anodization of crystalline silicon wafers, show bright red photoluminescence, at room temperature. Unfortunately, they degrade upon exposure to light and are very sensitive to ambient conditions. This has kept us from realizing the long cherished dream of making silicon based optoelectronic devices, so far.

In an attempt to solve this problem we first tried to understand the origin of degradation. In particular, we studied the effect of light soaking on nc-Si in different ambients. We found that the degradation is mainly caused by creation of non-radiative recombination centers (mainly, dangling bonds), which depends on the surface conditions

We protected the surface of nc-Si by applying a thin layer of a polymer. Several polymers were tried. Interestingly, we found that polystyrene not only protects it from ambient, it also arrests the photo-induced degradation of nc-Si. Evidence showing the formation of new bonding configurations at the nc-Si/polymer interface will be presented, which may be responsible for the improved stability.

If any faculty members wish to meet with the speaker or join us for a lunch or dinner please contact Shemeka Ezeff at 8-8243.

General Seminar

3:40PM / Thursday, 13 October 2005 / Room 109, Nicholson Hall

Host: Dr. Jonathan Dowling

[Refreshments served at 3:15 PM in Room 229, Nicholson Hall]

"Quantum Teleportation with Atoms"

Daniel F.V. James, PhD
Department of Physics, University of Toronto

Quantum teleportation is the complete transfer of the quantum state - in a sense the most fundamental notion of identity - from one particle to another. The complete specification of the quantum state of a system generally requires an infinite amount of information, even for simple two-level systems. Moreover, the principles of quantum mechanics dictate that any measurement on a system immediately alters its state, while yielding at most one bit of information. Thus transferring a state from one system to another, by performing measurements on the first and operations on the second, might therefore appear impossible. However the fundamental phenomenon of quantum state entanglement, in combination with classical communication, allows quantum-state teleportation to be performed. In this talk, we will discuss the process of teleportation, describe the demonstration of deterministic quantum-state teleportation between a pair of trapped calcium ions recently reported [*Nature* Vol. 429, p. 734 (17 June 2004)], and consider some of the implications.

Publications

"Limitations on the utility of exact master equations." G.W. Ford and R.F. O'Connell. *Annals of Physics* 319: 348-363 (2005)

"Search for periodicities in the ^{8}B solar neutrino flux measured by the Sudbury Neutrino Observatory." B. Aharmin, J. TM. Goon, T. Kutter, et al. *Physical Review* D 72, 052010(8), 2005.