PHYSICS DEPARTMENT COLLOQUIUM

" AVALANCHE FREE SINGLE PHOTON DETECTION"

BY

DR. Hans Robinson
UCLA

In commercial single photon detectors, such as the avalanche photo diode (APD) and photo multiplier tube (PMT), the gain mechanism consists of a multi-step “avalanche”, in which a single photo-induced charge generates several other charges, each of which in turn generates several charges, etc., until a macroscopic current pulse is created.

In this talk, I will present an alternative gain mechanism, where the electrostatic field from a trapped photo-charge induces a detectable change in the environment, for instance by changing the conductivity of a nearby device such as a quantum point contact or a single electron transistor. In this case, the gain mechanism consists of a single photo-charge influencing the passage of a very large number of other charges. Three experimental results will be presented as examples, using first an optical technique for detecting the charges, then electrical measurements of trapped photo-holes and photo-electrons respectively.

While this detection scheme will not replace conventional detectors, it has a possible application in quantum communication, as the detector in principle can be designed to preserve the quantum state of the absorbed photon, including any entanglement with distant particles. I will discuss how this property can be used to perform quantum cryptography over long distances -- establishing an intrinsically secure communications
channel between distant parties.

THURSDAY, FEBRUARY 19, 2004
4:00 PM IN 102 JFB
REFRESHMENTS AT 3:30 PM IN 219 JFB