3.46 PHOTONIC MATERIALS AND DEVICES

Design Review 3—Detectors

Due Dates:

May 10, 2006—MIT only

May 15, 2006—Singapore only

Team #1: Lucent Lama lives on the top of Mount Monadnock. He has solar power, a mountain stream of fresh water and enough blueberries to sustain him through the summer. He has determined that the meaning of life is baseball; therefore, he requires television reception of the Boston Red Sox to live a "meaningful life."

Clear Day Communications (CDC) has agreed to beam video to the top of the mountain by digitally encoding a HeNe laser beam. CDC will airlift a monitor, but Lama must provide detection of the red light at 1 Gbps with a BER of 10^{-12} to enable HDTV reception.

Create a design for his photodetector and specify a loss budget for the source-to-monitor system that determines the laser power.

Team #2: Homeland Security has commissioned your team to develop a device for 3D image recognition. The device is based on time-of-flight photon measurement. A pulse of light is broadcast on the subject and the reflected light is measured at each pixel in the focal plane array. The depth dimension is determined from the difference in path length (i.e., the difference in arrival time at the focal plane array).

Create a design for a photodetector that gives a 5 cm depth resolution. The light source must employ infrared photons to reduce subject awareness.

Team #3: MIT Search Engine (MITSE) has announced a new product that sorts pictures in the family album. This revolutionary tool, called *Find Grandma*, requires a monolithically integrated silicon photodetector for data I/O. A data rate of 10 Gbps is required for 850 nm light.

Create a design for a high responsivity photodetector based on a resonant cavity device that minimizes τ_{tr} while maintaining a high responsivity.