EE 119 Lab 5: Microscopes and Photodiodes

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Microscopes:

1. Examine the standard microscope in the lab. What are the magnifications of the eyepiece and objective? What is(are) the numerical aperture(s)? What is the total magnification? What is the working distance (at which distance from the objective lens is the image in focus?) How would you calculate the focal length of each lens? Why is there a lamp in the microscope?

2. Build a compound microscope using the lenses available in the lab. (Probably use f=100 mm and f=76.2 mm, or other combinations if you're curious to try out different lenses) What is the system magnification? Is it diffraction limited? Where is the exit pupil? What is the working distance?

Photodiode and PMT:

1. Turn on the strobe lamp and the photodiode. Turn off the main room light but keep the smaller fluorescence light on. Plug the BNC cable from the photodiode in channel 1 of the oscilloscope. Set the trigger source (in the upper right-hand corner) to channel 1 and set the coupling to DC coupling with 50Ω input impedance. Set the voltage scale on the oscilloscope to 2mV (the smallest spacing). Adjust the time step on the oscilloscope until you can see the pulsed from the strobe. The frequency of the strobe should be 60 Hz. Is it?

2. Now zoom in to one pulse from the strobe. Can you measure the duration of one pulse from the strobe? How long is it?

3. Now change the input coupling from 50Ω to 1MΩ. You will need to change the trigger level and adjust the voltage scale from 2mV to 1V or larger (why?) What happens to the measured duration of the pulses? When you are trying to make fast measurements with a photodiode, would you use low or high impedance?

4. The photodiode has an on and off switch that reverse-biases the p-n junction (you can take part another photodiode box and take a look at the circuit)? What is the purpose of this?

5. Now turn on the photomultiplier tube and repeat parts 1 and 2. How is the photo-multiplier tube different from the photodiode?