Physics 25 Problem Set 6

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due Monday, May 12

Please make your work neat, clear, and easy to follow. It is hard to grade sloppy work accurately. Generally, make a clear diagram, and label quantities. Derive symbolic answers, and then plug in numbers after a symbolic answer is available.

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1. Crawford 9.9... use the mesh handed out in class, and you only need estimate the average thread spacing. Be careful to look for the interference pattern, which produces 'fringes' with a smaller spacing than the overall 'envelope' caused by diffraction off the threads themselves. I found that either a flashlight, modified as the problem suggests, or a white keychain LED worked very well as a light source. A key point is that the interference pattern can be thought of as a function of angle; the further you back up from the source, the *smaller* the angle subtended by the source, while the interference pattern remains the same in angle. Thus, the further you move back from the source, the clearer the interference pattern becomes.

2. Crawford 9.16

3. Use the attached page to study diffraction in your eye. First, look in a mirror and use a ruler to measure the width of your pupil. Then print out the attached page, which has vertical lines of various spacings. Determine the distance from your eye to the sheet at when double lines with spacing 250 μm, 375 μm, and 500 μm appear to merge. Assume the wavelength of light is 550 nm, and compare the *angle* subtended by the merged lines with what you'd expect from diffraction off your pupil for these three cases. For your three distances, enter the data into the spreadsheet at: `http://hep.ucsb.edu/courses/ph25/lines.xls` and print out the 3 plots, and turn them in. Derive on your own, symbolically, the formulas used to make the plots in the spreadsheet.

4. Crawford 9.26 - use the diffraction grating glasses handed out in class.

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250 µm	500 µm	375 µm	875 µm	625 µm	750 µm