SURF OPT/AFM Initial Outline

Goals

1. Understand and improve Optical Tweezers.
2. Set up Atomic Force Microscope, see if we can make it work, find out what fun things can be measured.

Specific Safety Issues

- A dangerous invisible laser beam, delicate components, chemicals.

OPT

1. Receive appropriate laser safety training.
    - From Supervisor
    - UofT Laser Safety training on **Thursday 19 May 9am – 4pm**.
2. Become familiar with existing Thorlabs Optical Tweezers experiment.
    - Carefully follow instructions to avoid damage to equipment or yourself.
    - Confirm beam is fully enclosed (except at focal point).
3. Investigate how to best prepare samples. Are old samples still useable?
4. Study trapping of various size spheres, measuring trapping potential as a function of intensity, using videos analyzed by ImageJ or other software
5. Can diffraction patterns be used to measure height of sphere above the slide?
6. Investigate how to obtain or simply create other interesting samples, e.g. DNA with bead on end(s), polymers, powders, ….
    - Can they be purchased?
    - Can they be made easily?
    - Can we tie a knot in a DNA molecule?

AFM

1. Read about principles of Atomic Force Microscopy
2. Carefully and very gently inventory contents in box, and try to assemble AFM without removing any components from OPT.
    - Identify which additional components are needed (either from OPT or elsewhere). Get prices. Do ASAP, in case we decide to order them immediately.
    - Under supervision of professor, remove necessary components from OPT
    - Very carefully assemble AFM
    - How long and how difficult is it to switch between AFM and OPT modes?
3. What is resolution of AFM? How do we calibrate it?
    - Do we need a calibration grid to measure resolution? Would a grating do?
    - Is there some way to calibrate the force between the tip and the surface?
4. Try various dry (e.g. glass) and liquid samples (e.g. polymer solution).
    - How long do measurements take?
    - Is vibration a problem? Do we need to use the granite block?
5. How many tips do we have, how fast are they used up, how much do they cost?
6. What kind of modes can the AFM operate in?