PROJECT(S)

For each student, one report. You have one half day to do the measurement, and the rest of the semester do do the report. One report per student.

1 Demos or "projects"

1.1 Fresnel equations.. and more

1.1.1 Transmission/reflection near grazing incidence (1)

You will be provided a He-Ne laser, a polarizer sheet, a few lenses, mounts, mirrors, a 75 mm DIA, 1 mm thickness window of fused silica, and a detector. You are asked to measure the transmission at a grazing incidence angle for different polarizations. In particular, determine the ratio of s to p in transmission. Be thorough. Make sure to measure all parameters that may affect the measurement. As is often the case in research, you will not be able to return to the measurement. Therefore, do not leave any stone unturned, or make the assumption that "this parameter is not important". Ask if you think you may need any additional optical component. Be creative in designing each measurement for maximum accuracy. Compare the polarizing properties at grazing incidence versus Brewster incidence.

1.1.2 Transmission/reflection near grazing incidence (2)

Variation of (1) where the He-Ne laser is replaced by a 100 fs pulse of a Ti:sapphire laser.

1.1.3 Transmission/reflection near grazing incidence (3)

Variation of (1) where the thin Ti:sapphire place is replaced by a 2 Wedge

1.2 Polarization

1.2.1 The poor man's waveplate

Create a large aperture waveplate (5 cm) $\lambda/2$ and $\lambda/4$ with kitchen plastic wrap. Establish the order, bandwidth, and homogeneity. More Challenging: optimize the waveplate for a fs Ti:sapphire pulse.

1.2.2 Polarization control

We want to change a polarization to the orthogonal state (for linear and circular polarized light. Compare using geometry or waveplates or a glass corner cube.

1.2.3 How to measure the axis of a waveplate

A quarter wave produces circularly polarized light from a linearly polarized source. Find a method to determine the sense of rotation. You will be given a silver or aluminum mirror of which you can calculate the phase shift on reflection as a function of angle.

Can this be used to find the fast axis of a polarization maintaining fiber?

1.2.4 Fabry-Perot transmission/reflection of cw or short pulse laser

1.2.5 First versus second order autocorrelation of ultrashort pulse

1.2.6 Use of sampling scope (cable dispersion, decorrelation of the signal, etc)

1.2.7 White light interferometry

1.2.8 Grating analysis

You are given a unknown grating. Find the characteristics