Kerr Effect Measurement of Magnetized Photocathode

**Part I – Become familiar with polarized light and optical measurements**

Basic Setup

1. Find low power (<20 mW) laser and parts needed to do this:
2. Send light to power meter to get familiar with power level and control
3. Add a polarizer to define plane of polarization
4. Add an analyzer to find maximum and minimum e.g. “Law of Malus”
5. Between cross polarizers vary angle of half- and quarter- wave plates
6. Compare the different configurations to Thorlabs optical polarimeter

Photodiode and Scope Setup

1. Find a photodiode and scope to see intensity signal in real time
2. Define polarization and analyzing planes of crossed polarizers
3. Convince yourself that intervening half-wave plate can leak light
4. Insert Hinds AOM and demonstrate it works as a fast waveplate
5. Use lock-in amplifier to extract the AOM amplitude using photodiode
6. Compare the configuration to the Thorlabs optical polarimeter

**Part II – Test Kerr signal using a magnetized foil**

Basic Setup – Analyze linear polarization angle from iron foil

1. Find iron foils, pucks and permanent magnets
2. Reflect laser off un-magnetized iron foil between cross-polarizers
3. Use (variable) waveplate to test sensitivity to linear polarization plane
4. Test signal as permanent magnets are added (measure field) to foil
5. Move magnets relative to foil, test sensitivity
6. Learn how to demagnetize the foil

Advanced Setup – Photodiode and Scope Setup

1. Try Thorlabs polarimeter or fast photodiode to measure signal
2. Repeat basic setup using the Hinds modulator; vary the foil magnetization
3. Evolve sophistication of setup to best resolve plane of polarization

**Part III – Kerr measurements of magnetized puck**

Setup – Integrate your diagnostic at Magnet Measurement Facility (MMF)

1. Become familiar with the new magnet coil geometry, field
2. Devise a means to add your foil and with geometry like that of photogun
3. Move or re-build your Kerr diagnostic at the MMF

Experiment

1. Measure plane of polarization vs. power supply current (magnetic field)
2. With MMF help measure magnetic field at face of iron