

PHYS 251: Atomic Physics Lab

Due date: Tuesday, Oct. 18, 2022 by 11:59 pm on Gradescope (both sections)

### **Pre-Lab Exercise: Faraday Rotation**

#### **Problem: Optimal Polarizer Angle**

Consider equation 4 of the lab instructions. The intensity  $I_0$  from the laser is constant, and we keep the angle of the second polarizer  $\theta$  constant as well. If we now use the Faraday effect to make the induced polarization rotation angle  $\phi$  wiggle around zero, so that  $\phi(t)$  wanders between  $+\Delta\phi$  and  $-\Delta\phi$ , then the intensity  $I$  of the laser into the photodiode will wiggle as well, i.e.  $I(t)$  will wiggle between  $I + \Delta I$  and  $I - \Delta I$ .

**Question:** What fixed angle  $\theta$  (in degrees) for the second polarizer will yield the largest laser intensity wiggle  $\pm\Delta I$  on the photodetector for a given  $\pm\Delta\phi$  Faraday polarization rotation wiggle?

(Show your work)