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 θ constant as well. If we now use the Faraday effect to make the induced polarization rotation angle ϕ 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 θ (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)