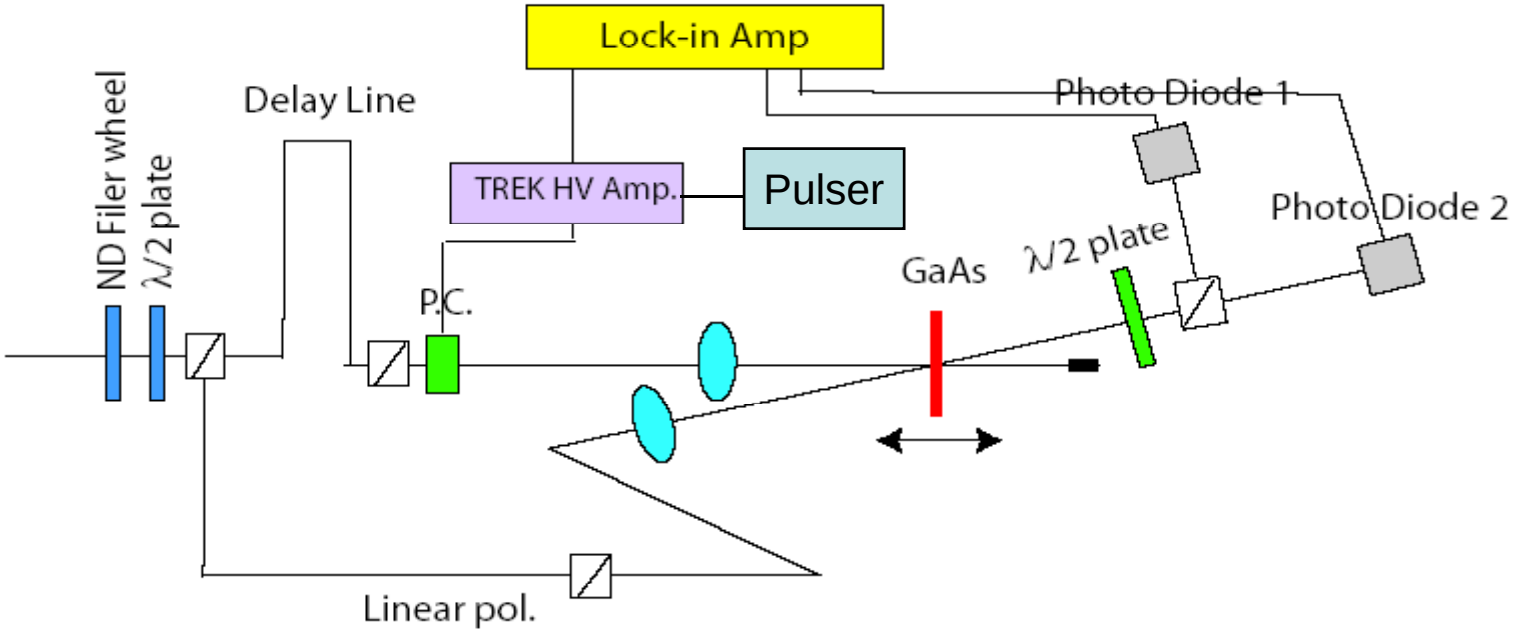
Faraday Rotation Experiment

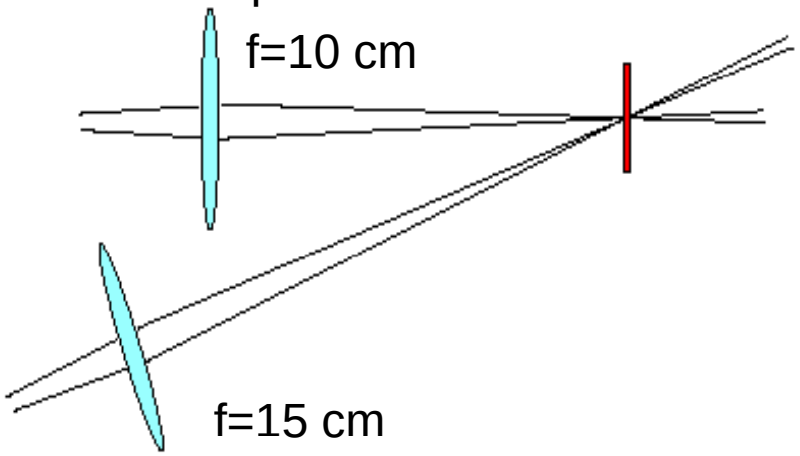


Three conditions to see signal:

- **Pump and probe beams must overlap.**
- **The active layer must be within ~300 um, requiring the sample Z scan.**
- **The pump and probe lines must be within ~1 cm, while the tape measure accuracy is ~1 cm.**

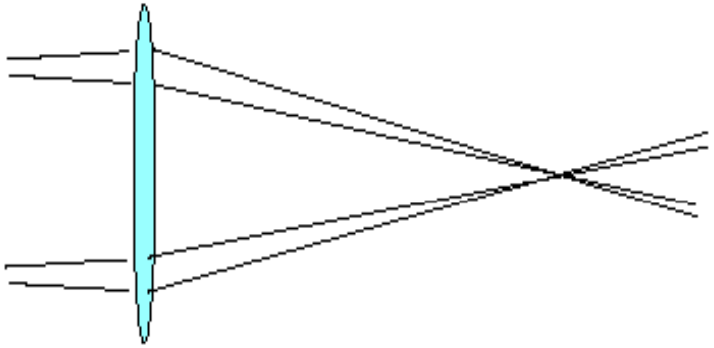
Optics

Two lens optics



- Much more difficult
  - Beam does not focus at the nominal focal length; the focal point is slightly longer than the nominal focal length.
  - Two beams must focus at the same point.

Single lens optics

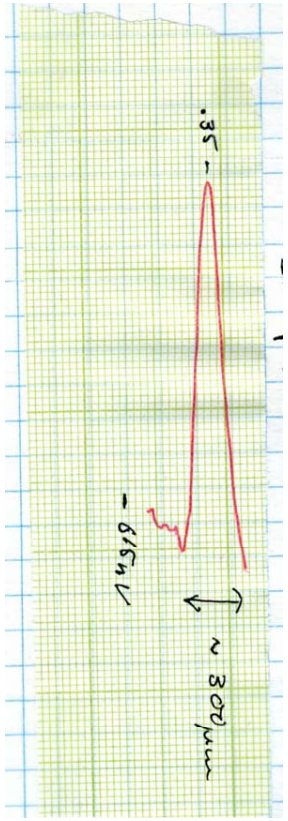


- Much easier
  - Many groups use this optics.
  - Since the beam does not go through the lens center, there is an astigmatism and the beam spot is not round at the focal point.

50, 75, and 100 um pin holes have significantly improved the alignment.

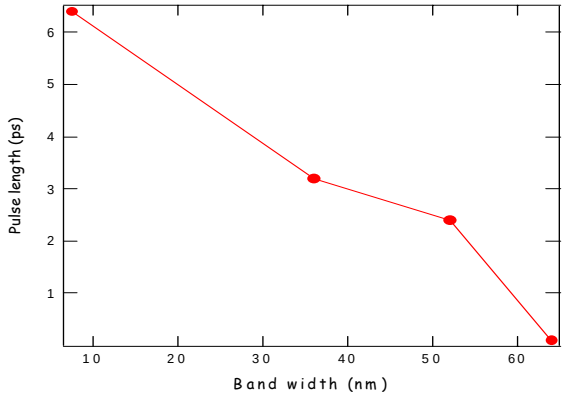
Faraday signal from bulk GaAs

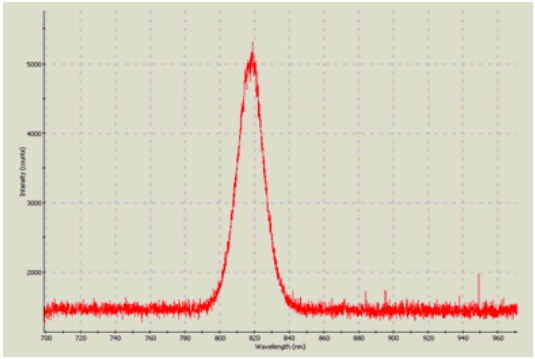
Sample Z-scan



- Laser

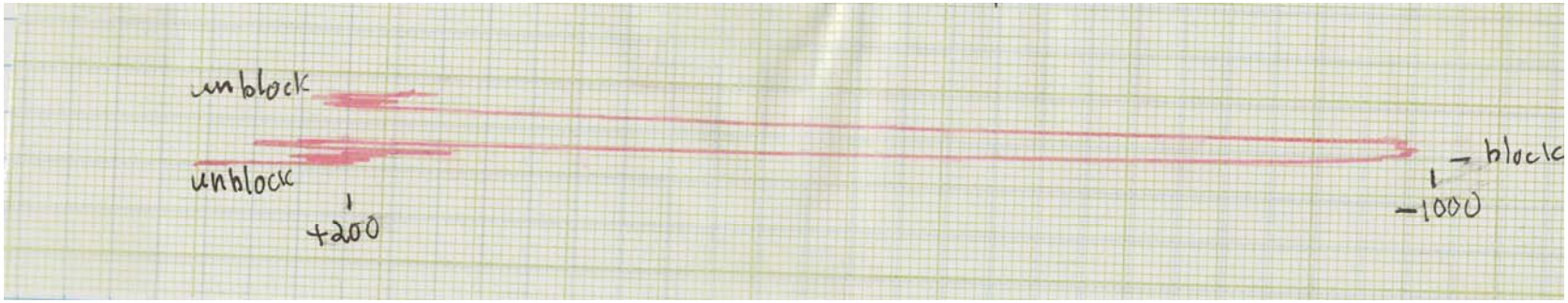
  $\lambda = 818$ nm; ~5 ps



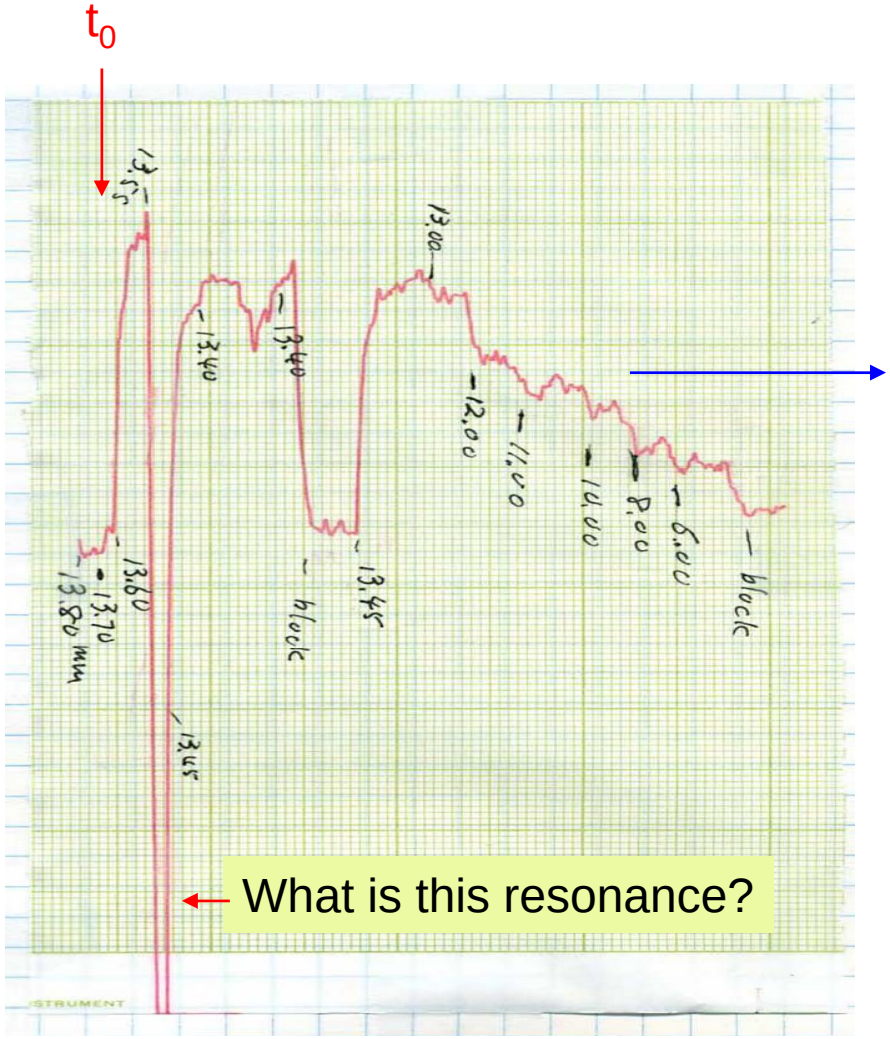


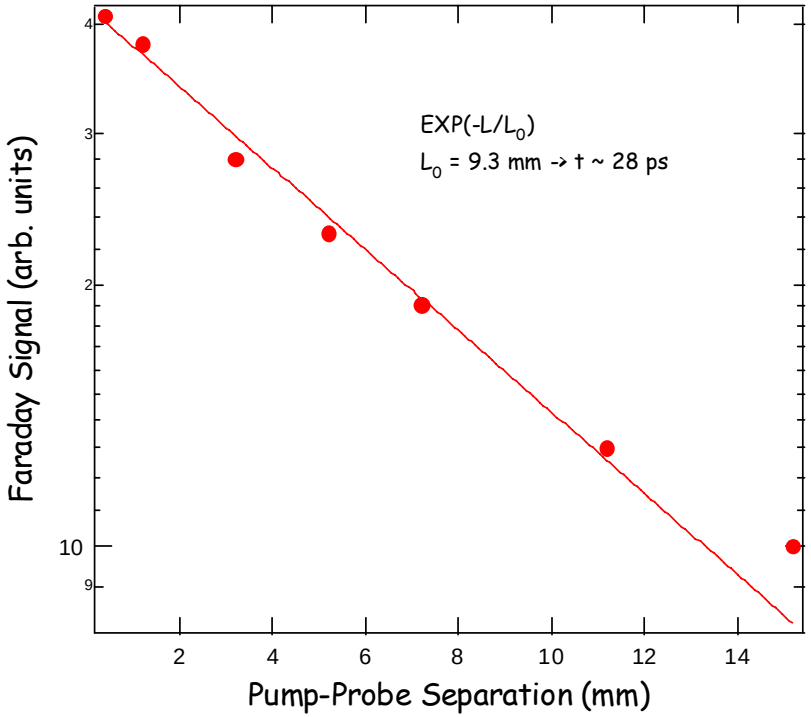
Pump/probe powers: 2.4 mW/0.3 mW

Faraday signal



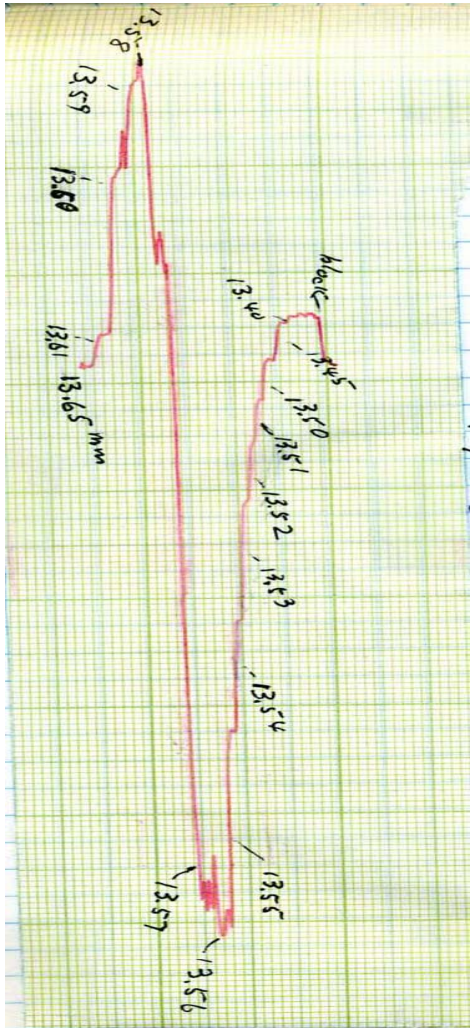
Time dependence





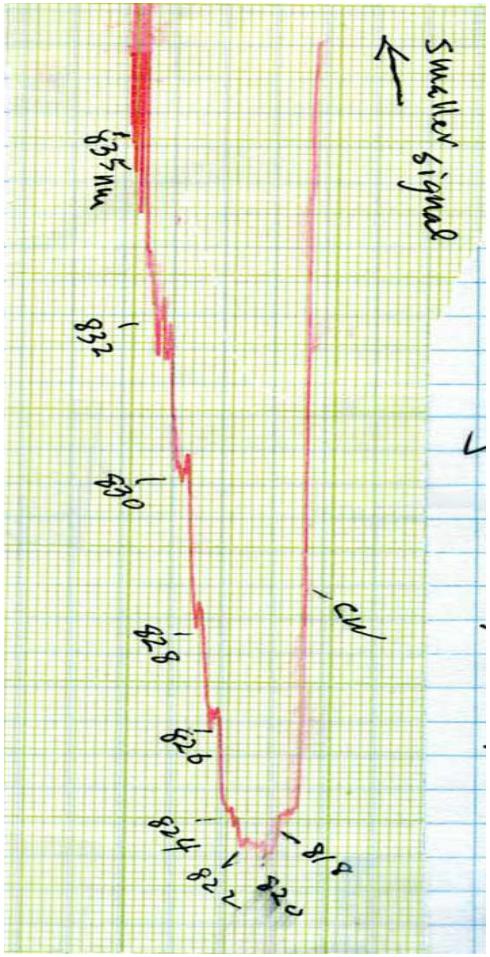
What is this resonance?

Strong time dependence.



~0.13 mm →~0.8 ps

Strong wavelength dependence.



No signal for CW.

No polarization,
no signal.

Conclusions

- We have a reproducible signal, but we don’t understand exactly what we see.
- We need an n-doped or semi-insulating bulk GaAs reference sample. No Faraday data for highly p-doped (1×10^{19} cm^{-3}) bulk GaAs.
- Try AOM-based pulse-picker (purchased by Wisconsin).