Group 5 — Sudip K.C., Lalit Chaudhary

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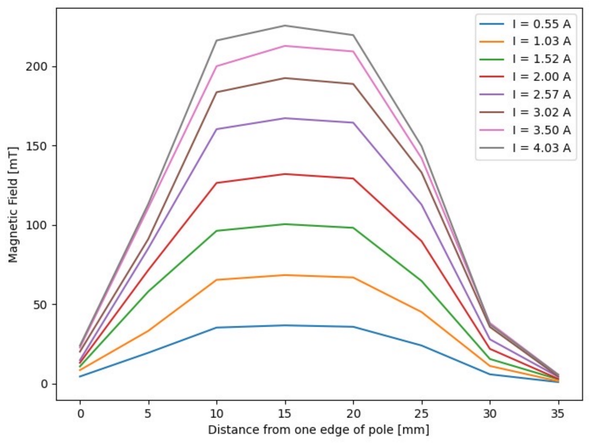
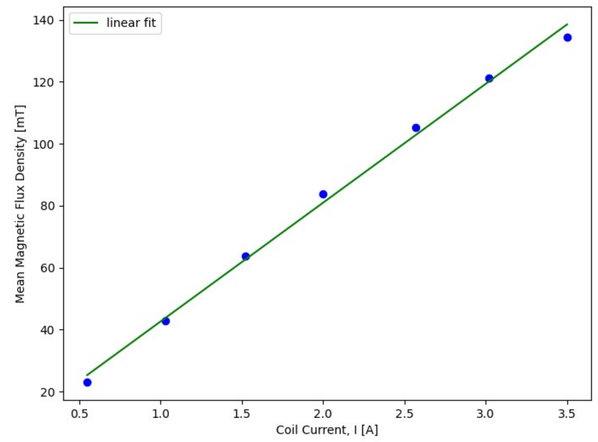
Faraday and Kerr Effect

I. Faraday Effect

a. Relationship between magnetic flux density and current

Current [A]	Magnetic flux density in steps of 5mm (mT)							
	0	5	10	15	20	25	30	35
0.55	4.35	19.30	35.2	36.6	35.7	23.9	5.73	0.84
1.03	8.38	33.1	65.3	68.3	66.8	45.0	11.0	1.39
1.52	10.7	57.9	96.2	100.4	98.1	64.6	15.4	2.62
2.00	13.0	71.4	126.4	132.0	129.2	89.7	21.8	2.87
2.57	14.65	85.1	160.3	167.2	164.4	112.7	27.8	4.18
3.02	20.0	91.0	183.6	192.5	188.8	133.0	35.6	4.41
3.50	22.6	110.5	200.0	212.8	209.3	142.8	38.1	5.60
4.03	23.8	113.1	216.2	225.6	219.6	149.6	37.2	5.46



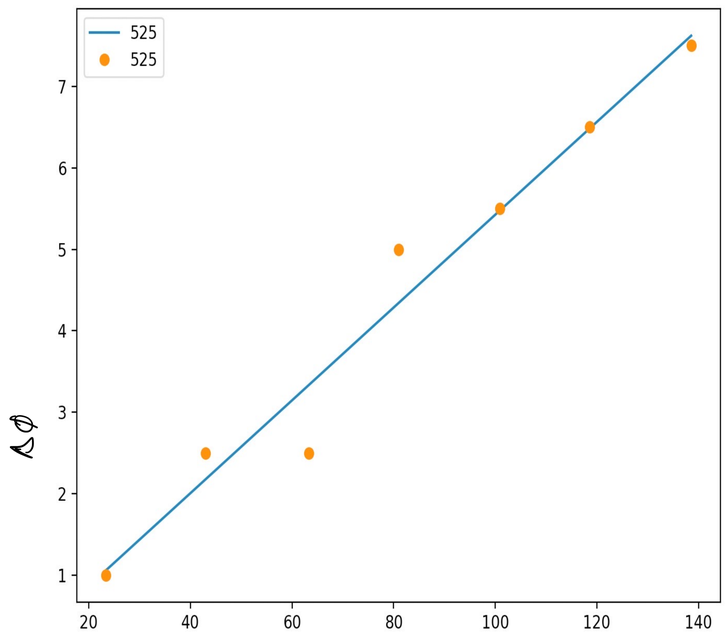


Variation of magnetic field with current

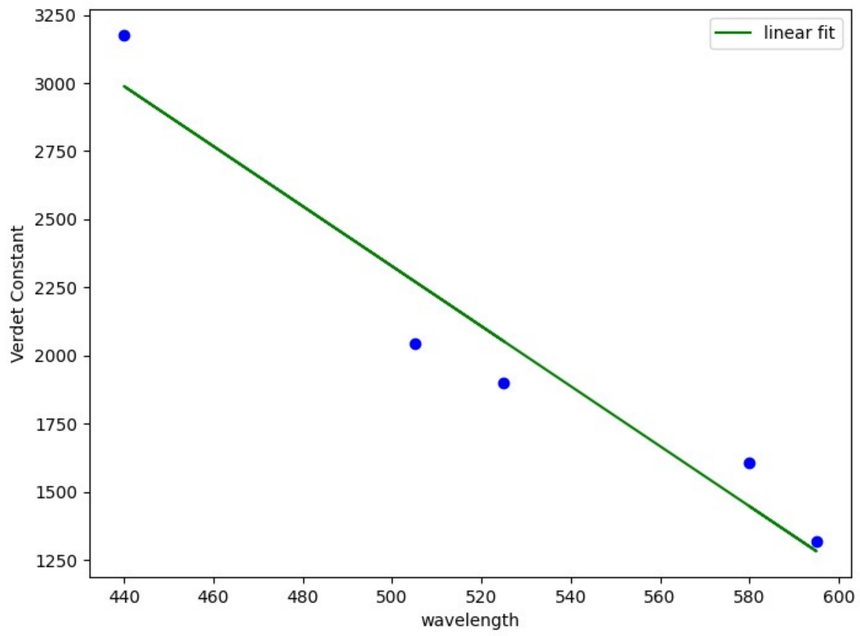
Line of fit:

$$B = (38.37\,I + 1.06)\,mT$$

λ (nm)	Current (A)	Position 1	Position 2	2.Δφ	Slope (Bvs φ)	Verdet constant
440	2.06	39	54	15	0.095	3176.05
	1.92	40	53	13		
	1.26	42	54	12		
	1.02	43	50	7		
	0.69	46	50	4		
	0.26	45	48	3		
505	0.27	48	49	1	0.061	2042.42
	0.80	47	49	2		
	1.37	45	50	5		
	1.74	44	52	8		
	2.33	42	52	10		
595	2.08	45	51	6	0.039	1317.52
	1.73	45	51	6		
	1.46	46	50	4		
	1.06	45	50	5		
	0.55	48	49	1		
580	0.54	47	48	1	0.048	1608.82
	1.09	46	50	4		
	1.54	46	50	4		
	2.05	46	51	5		
	2.58	44	52	8		
	3.01	43	54	11		
	3.50	42	54	12		
525	2.98	41	54	13	0.056	1899.35
	3.50	40	55	15		
	2.52	42	53	11		
	2.00	43	53	10		
	1.54	45	50	5		
	1.01	45	50	5		
	0.50	47	49	2		



Variation of Δφ with B for λ = 525 nm



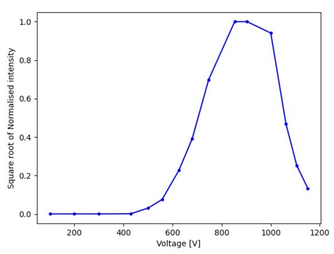
Variation of Verdet constant with wavelength

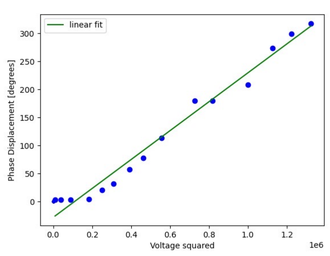
II. Kerr Effect:

Amplification set to 100.

I_o = 13.87 V

Voltage (V)	Intensity (I)
105	
430	0.02
500	0.43
557	1.04
626	3.16
680	5.43
747	9.69
800	13.87
853	13.87
904	13.87
1000	13.05
1062	6.50
1106	3.50
1151	1.85





$$\text{Slope} = \frac{\Delta}{U^2} = 2.5 \times 10^{-4}$$

$$\Rightarrow K = \text{Slope} \cdot \frac{d^2}{\pi L} \cdot 2$$

$$\therefore \boxed{K = 5.36 \times 10^{-8}\ m/V^2}$$