LAB 5: Diffraction and Interference
Agam Chopra

Data Analysis:

Fig1. Raw noise data collected by the CCD for 10ms, 100ms, and 500ms exposures.

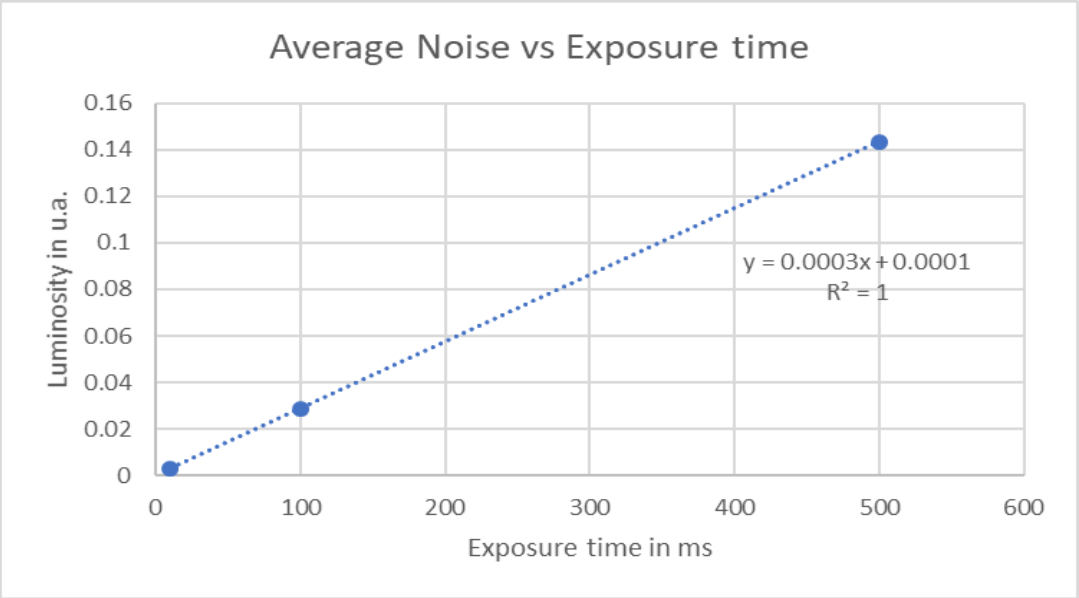


Fig2. Average Noise for the data in Fig2. Plotted as a linear function with respect to Exposure time

From my analysis of the averages of the noise, the noise follows a linear pattern with respect to the exposure time which makes sense. I used this relationship to approximately predict noise values for each y value at the required exposure times for the data in rest of this report.

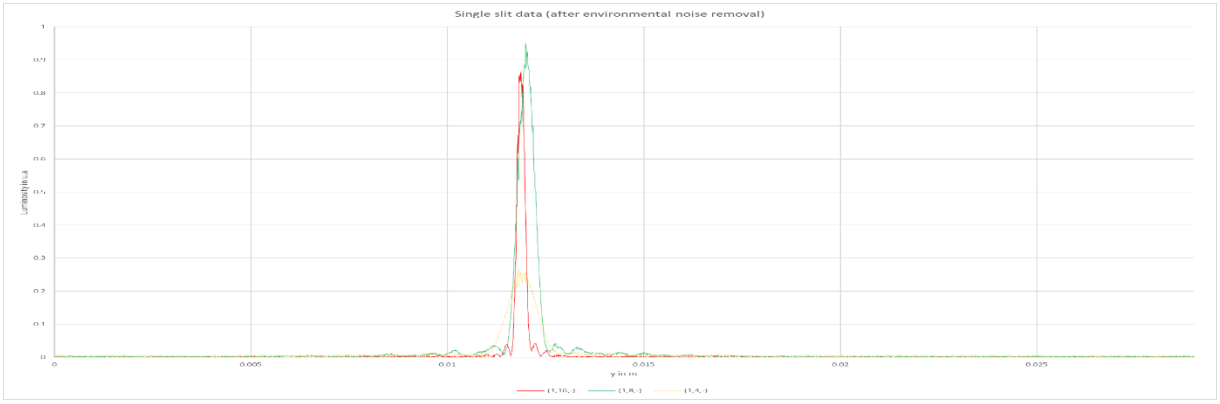
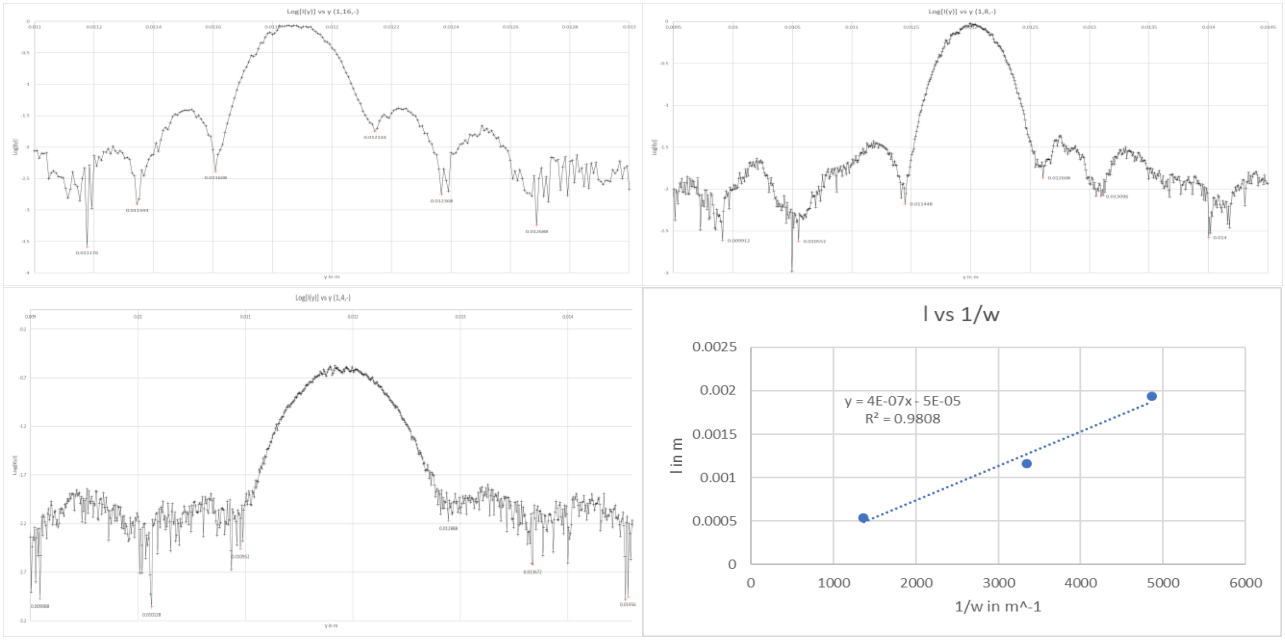


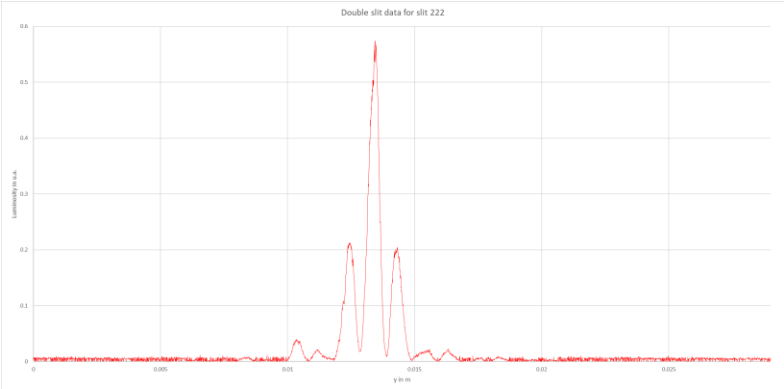
Fig3. Observed data for the single slit diffraction experiment.

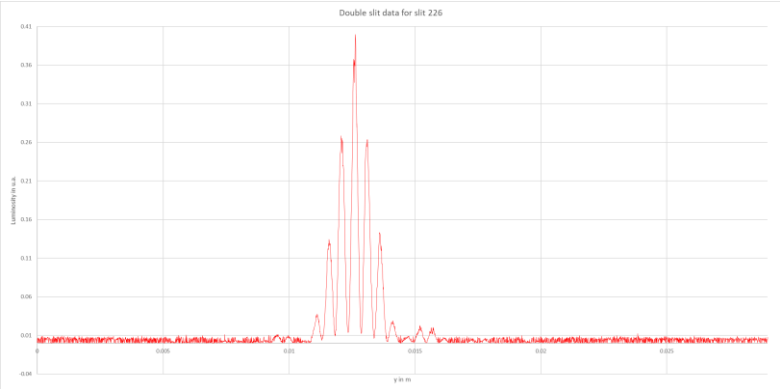


m	ym w16	ym w8	ym w4	d(ym)		Lm	<ym>	d(<ym>)	wm	d(wm)	<w>	± S/(N^1/2)	I
-3	0.011176	0.009912	0.009088	5E-07	(1,16,-)	0.000536	0.000268	7.07E-07	0.000708582	2.37E-05	0.00073369	0.00050144	0.000536
-2	0.011344	0.010552	0.010128	5E-07	w16	0.001024	0.000512	7.07E-07	0.000741797	2.48E-05			
-1	0.011608	0.011448	0.010952	5E-07	0.0007029	0.001512	0.000756	7.07E-07	0.000753571	2.52E-05			
1	0.012144	0.012608	0.012888	5E-07	(1,8,-)	0.00116	0.00058	7.07E-07	0.000327414	1.09E-05	0.00029897	0.00020429	0.00116
2	0.012368	0.013096	0.013672	5E-07	w8	0.002544	0.001272	7.07E-07	0.000298585	9.97E-06			
3	0.012688	0.014	0.01456	5E-07	0.0003515	0.004088	0.002044	7.07E-07	0.000278718	9.3E-06			
Single slit		f2	N	λ	(1,4,-)	0.001936	0.000968	7.07E-07	0.000196178	6.55E-06	0.00020568	0.00014057	0.001936
analysis		0.3	3	6.33E-07	w4	0.003544	0.001772	7.07E-07	0.000214334	7.15E-06			
Note: all distance values are in meters.					0.0001757	0.005472	0.002736	7.07E-07	0.000208224	6.95E-06			

Fig4. Data analysis for Single slit diffraction experiment.

Selecting the (1,16, -) data shows that the observed values of the relative intensities at the subsidiary maxima closely match the theoretical values.





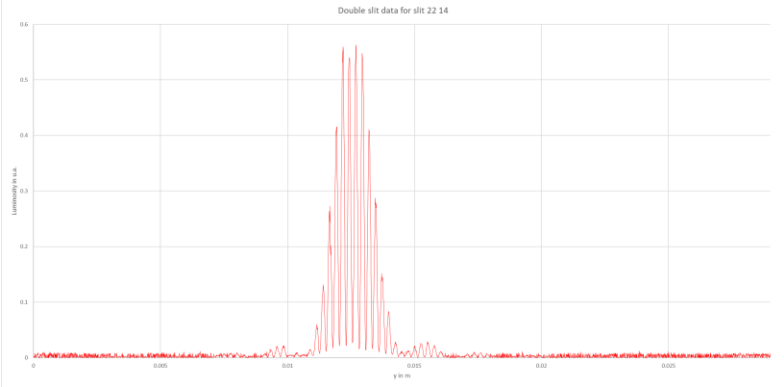
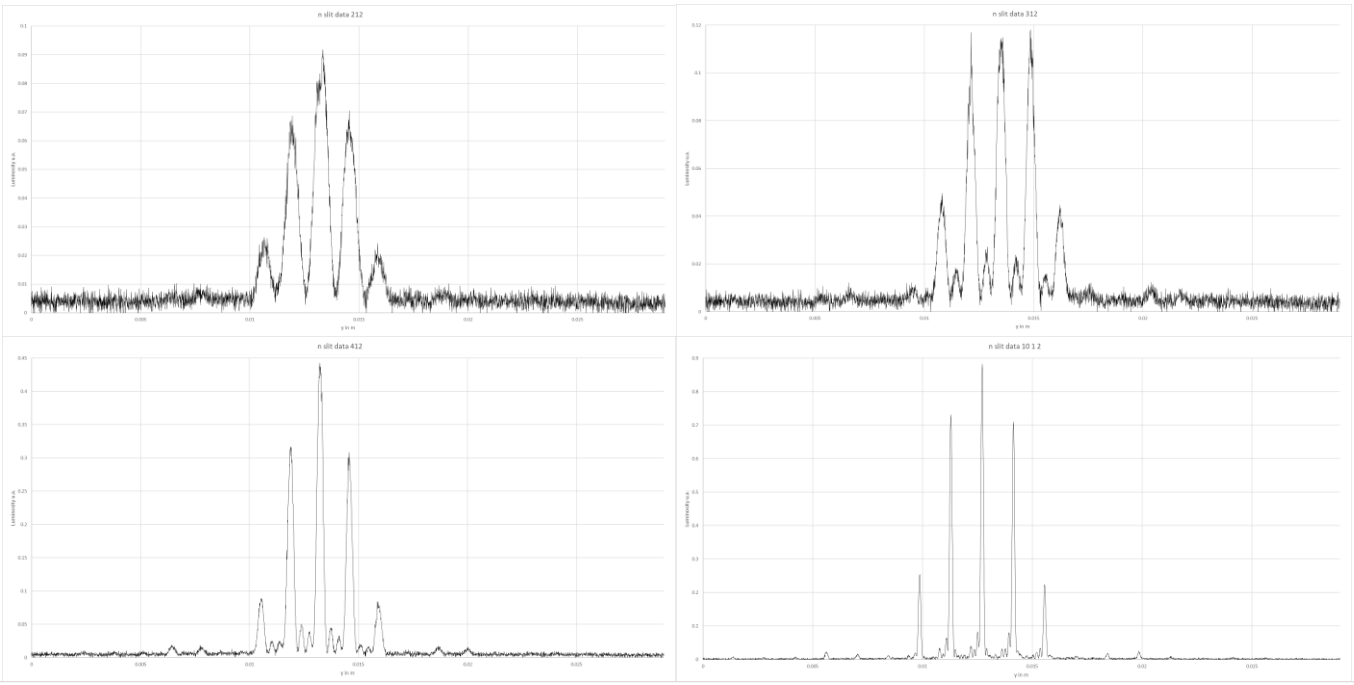
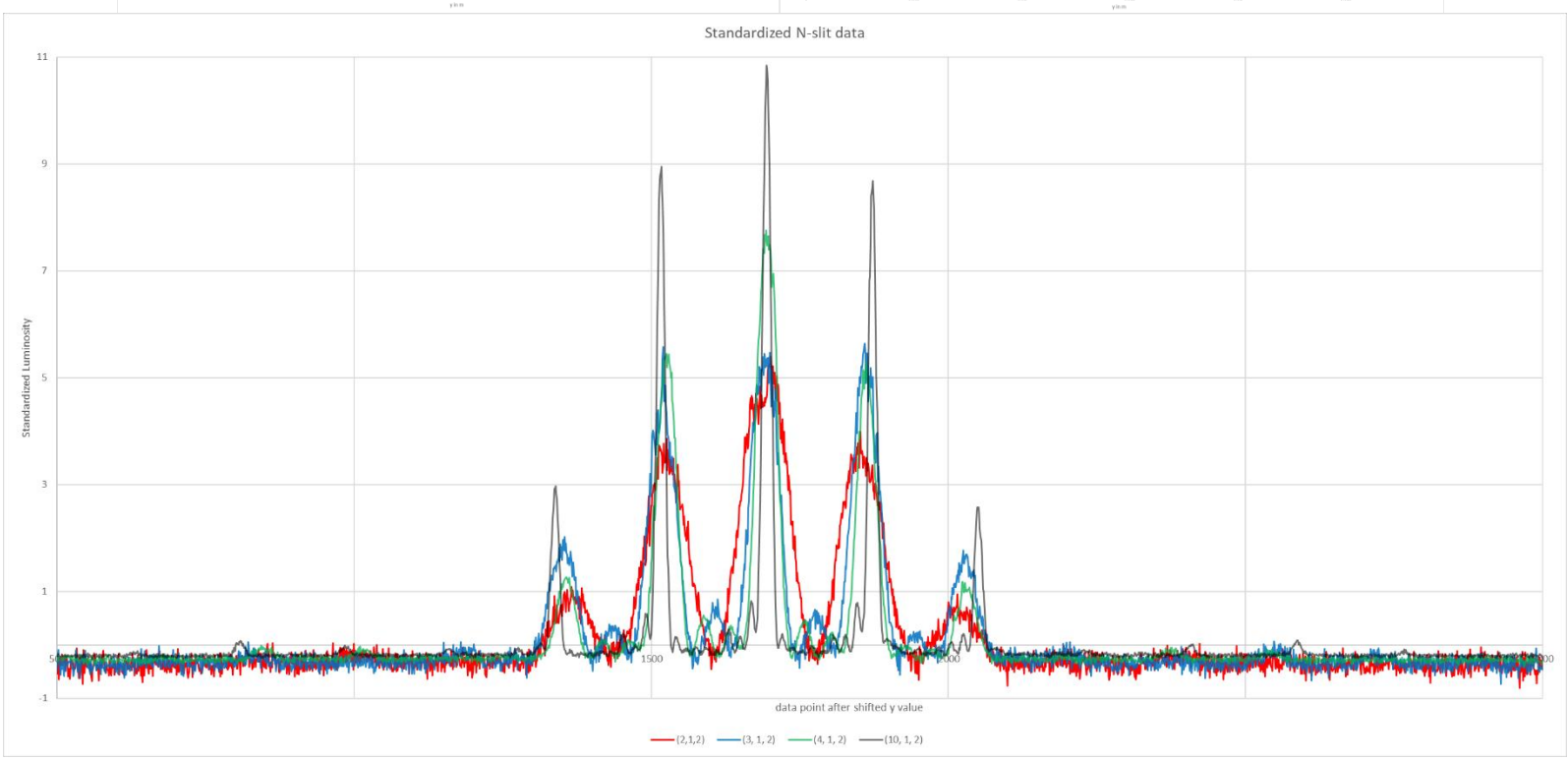


Figure5. Raw data after noise reduction and data analysis for interference by double slit experiments.

f2	λ	(in m)	(2,2,2)	(2, 2, 6)	(2, 2, 14)
0.3	6.33E-07	N	2	2	2
		w	8.79E-05	8.79E-05	8.79E-05
		e	8.79E-05	2.64E-04	6.15E-04
		d	1.76E-04	3.52E-04	7.03E-04

		yn			ln		<yn>			λn			d(λn)			<λ>			± s/(N^1/2)		
n	(2,2,2)	(2, 2, 6)	(2, 2, 14)	(2,2,2)	(2, 2, 6)	(2, 2, 14)	(2,2,2)	(2, 2, 6)	(2, 2, 14)	(2,2,2)	(2, 2, 6)	(2, 2, 14)	(2,2,2)	(2, 2, 6)	(2, 2, 14)	(2,2,2)	(2, 2, 6)	(2, 2, 14)	(2,2,2)	(2, 2, 6)	(2, 2, 14)
-10	0.003312	0.007755	0.010116																		
-9	0.004324	0.008235	0.010374																		
-8	0.005336	0.008715	0.010633																		
-7	0.006348	0.009195	0.010892																		
-6	0.00736	0.009675	0.011152																		
-5	0.008372	0.010155	0.0114																		
-4	0.009384	0.010635	0.011672																		
-3	0.010472	0.011112	0.011936																		
-2	0.011256	0.0116	0.012184																		
-1	0.012496	0.012072	0.01244																		
1	0.014336	0.013104	0.012944	0.00184	0.001032	0.000504	0.00092	0.000516	0.000252	3.76E-05	4.22E-05	4.12E-05	6.27E-06	7.03E-06	6.86E-06	1.61E-04	1.51E-04	1.64E-04	2.23395E-05	1.95542E-05	2.27903E-05
2	0.015568	0.013608	0.013208	0.004312	0.002008	0.001024	0.002156	0.001004	0.000512	8.11E-05	7.56E-05	7.71E-05	1.35E-05	1.26E-05	1.28E-05						
3	0.01636	0.014128	0.013456	0.005888	0.003016	0.00152	0.002944	0.001508	0.00076	1.05E-04	1.08E-04	1.09E-04	1.76E-05	1.80E-05	1.81E-05						
4	0.017445	0.014637	0.013704	0.008061	0.004003	0.002032	0.004030667	0.002001	0.001016	1.35E-04	1.34E-04	1.36E-04	2.26E-05	2.24E-05	2.27E-05						
5	0.018457	0.014744	0.013984	0.010085	0.004589	0.002584	0.005042667	0.002295	0.001292	1.60E-04	1.46E-04	1.64E-04	2.67E-05	2.43E-05	2.73E-05						
6	0.019469	0.015208	0.014232	0.012109	0.005533	0.00308	0.006054667	0.002767	0.00154	1.82E-04	1.66E-04	1.85E-04	3.04E-05	2.78E-05	3.09E-05						
7	0.020481	0.015704	0.01449	0.014133	0.006509	0.003597867	0.007066667	0.003255	0.001798933	2.02E-04	1.86E-04	2.06E-04	3.37E-05	3.10E-05	3.43E-05						
8	0.021493	0.016176	0.014747	0.016157	0.007461	0.00411421	0.008078667	0.003731	0.002057105	2.20E-04	2.03E-04	2.24E-04	3.67E-05	3.39E-05	3.74E-05						
9	0.022505	0.016556	0.015005	0.018181	0.008322	0.004630552	0.009090667	0.004161	0.002315276	2.37E-04	2.17E-04	2.41E-04	3.95E-05	3.61E-05	4.02E-05						
10	0.023517	0.016977	0.015262	0.020205	0.009222	0.005146895	0.010102667	0.004611	0.002573448	2.52E-04	2.30E-04	2.56E-04	4.20E-05	3.83E-05	4.27E-05						





a) Yes, if d is constant, the pattern observed will be consistent regardless of the number of slits.
b) Yes, the intensity of the maxima increases with increasing N i.e. no. of slits by N^2.
c) Yes, the with observed in the above plot of the data suggests that width of the maxima is proportional to 1/N.
d) From the observed data, it can be observe that there exists N-2 fringe patterns between any 2 adjacent maxima.