Interferometry Session 4

Wednesday, November 2, 2022 11:57 AM

Welcome to Martin's Lab Book.
The work in the following section was completed on:

Friday, January 20th, 2023
9am – 12pm
in a synchronous manner becoming of a lab workbook.

Aims

- We are supposed to have a green singlet and yellow doublet from the Hg lamp.
- Take a interferogram for finding the green doublet.
- Care was taken to prevent blindness by wearing safety spectacles.
- Estimate the width of the line, and work out the crossing points of the interferogram using calibrate.py. We know that the real wavelength is 546.0nm. Take a FFT.
- Examine the yellow doublet, finding the mean wavelength, line separation, width and then take an FFT of the interferogram.

Preamble: Mercury Lamp Source

UVP penray mercury lamps are typically filled with a mixture of mercury vapor and an inert gas such as argon, neon, or krypton. The exact composition of the gas mixture may vary depending on the specific model and manufacturer, but the primary component is usually mercury vapor.

Typical Intensities of UVP Pen-Ray Lamps

Lamp Current	*Typical Intensity 254nm @ 0.75" (microwatts/cm2)*	*Typical Intensity 365nm @ 0.75" (microwatts/cm2)*	*Lamp Operating Voltage*	*Lamp Body Temperature (degrees C)*
90-0012-01 (Model 11SC-1)				
5 mA AC	2000	65	375	55
10 mA AC	3600	105	330	80
15 mA AC	4400	145	300	100
25 mA AC	4750	215	260	145
35 mA AC	4100	330	230	185
90-0019-01 (Model 11SC-1L)				
20 mA AC		1213	280	120
25 mA AC		1280	260	145
30 mA AC		1298		
35 mA AC		1255	230	185
90-0020-01 (Model 11SC-2)				
5 mA AC	1150	30	240	60
10 mA AC	1850	50	215	85
15 mA AC	1900	70	200	105
25 mA AC	1700	130	185	155
35 mA AC	1500	210	190	200
90-0004-01 (Model 3SC-9)				
5 mA AC	800	50	590	30
15 mA AC	3300	130	600	39
25 mA AC	5400	200	570	48
35 mA AC	6700	250	530	54
50 mA AC	6900	300	480	64

Task 10 – The Hg Green line
The laser may have had instabilities but QM means that the Hg spectral lines must be stable (in normal conditions). So take a long (several mm) interferogram of the green line.

1. *Use this run and equations 4 and 5 to estimate the width of this line.*

2. *Investigate the stability and reproducibility of the distance moved by the stage.*
3. *You might want to do this by looking at the crossing points of the interferogram using calibrate.py. The real wavelength 546.0nm*
4. *What happens if you take an FFT of your interferogram. You should quantify your measurements in this task and remember that measurements are meaningless without errors.*

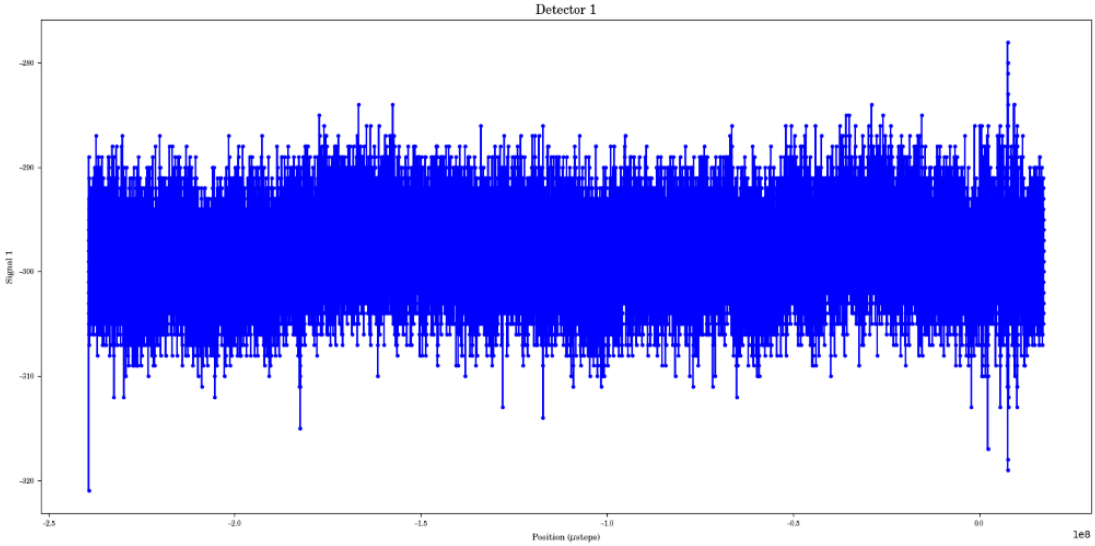
To begin with, we estimated the width of the Mercury Green spectral line, which was found to be:

[INSERT WIDTH OF HG GREEN]

Then following this, the white LED was switched for a Mercury lamp. Safety goggles were worn throughout to ensure protection from UV wavelengths of light. The light source was turned off when not in use.

As a result, we arrive at the following preliminary data shown in **Figures 1-3**.

Preliminary Data



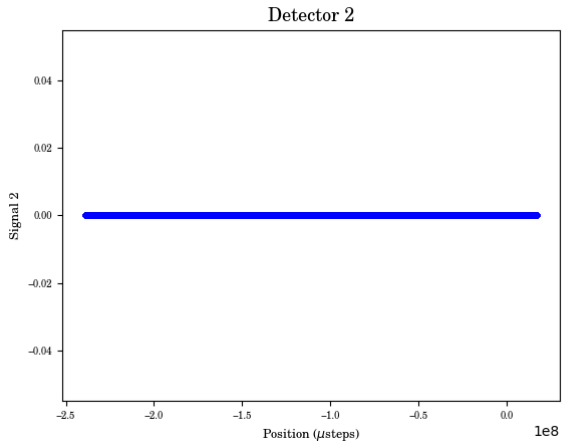
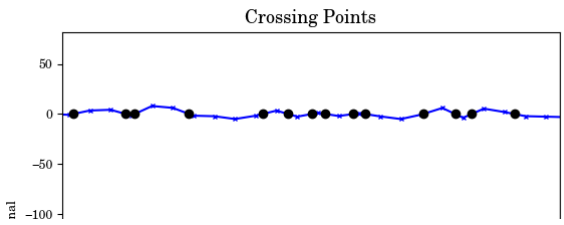


Figure 1: Preliminary data. This is the un-FFT'd data. Only Detector 1 was in use.



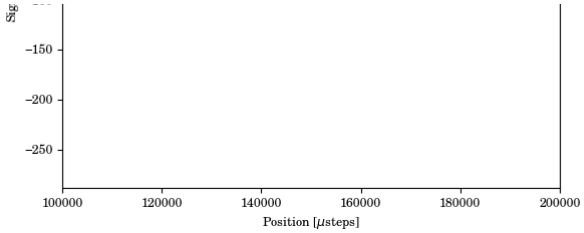


Figure 2: Preliminary data. This is the position of the crossing points.

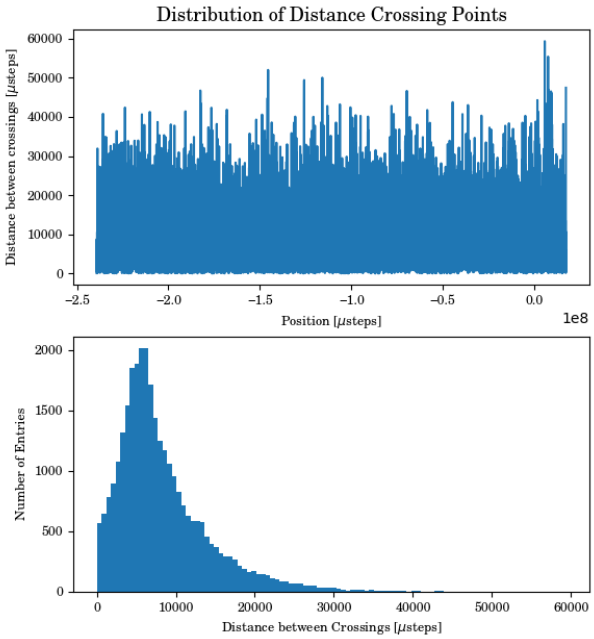


Figure 3: Preliminary Data. Distribution of crossing points.

Final Data

Several issues were encountered during the collection of preliminary data. In the first round of data collection, this entailed simply forgetting to turn on the Mercury lamp. This wasted 1 hour of lab time, and so once we had ensured we had turned on the lamp, we ran it a second time, resulting in the data shown in **Figures 1-3**. Despite this, we were still told by demonstrators that our data was no as we should have expected, and that in fact, it should be more sinusoidal in behaviour, like beats.

Task 11 – Examine the Yellow doublet

Take a long interferogram of the Hg doublet and use it to measure:

1. *The mean wavelength*
2. *The separation of the lines (using equation 3)*
3. *The widths of the lines (using equations 4 and 5)*
4. *Take the FFT of the of the interferogram. Does what you see make sense?*

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