2021 OPhO Invitational Experimental Clarifications

MAJOR NOTES

- **Last updated: August 15, 6:25 pm GMT**
- We will only be adding clarifications that cannot already be found in the exam. If you are not seeing your clarification answered, try looking through the exam again to see if you did not miss anything.

Problem Notes

Important: There is a bug in the code. The width = λ case simulates a *thin slit*. In general, the code does not perfectly simulate thick slits. Using the background information section, you should be able to see why. However, it is possible to account for this (and mitigate the error) in problem **1.2 & 1.3** by picking appropriate sizes/locations for the slits.

For the rest of the problems, all slits are assumed to be very thin, so this does not apply.

- **E1**
    - **1.2** Note that the problem states the current code simulates slits 10 lambda apart, but in the actual code, it simulates 8 lambda apart. This is a typo, but it should not affect things.
        - **You are free to change the slit spacing and slit size in order to simulate a double slit experiment with 2 wide slits. Take into account the important note above.**
    - **1.2** If you do not see any deviations, then report that.
    - **1.4** Use previous problems to solve this. A purely mathematical solution will not get full points.
    - **2.1** Partial marks can be awarded for correct solutions that don't use Fourier optics.
    - **2.3** You must prove that the slit pattern gives the correct amplitude function for full points.
    - **3.1 "**each slit can reduce the wavelength by some factor" is a typo
        - **should be "reduce the amplitude by some factor"**
    - **3.1/3.2** The data files can be found on the website (you must log in to see it, otherwise they are below):
        - https://opho.physoly.tech/static/files/E1-3.1.csv
        - https://opho.physoly.tech/static/files/E1-3.2.csv
    - **3.1: The graph for 3.1 shows intensity, but the data for 3.1 actually shows the amplitude. Sorry for the confusion.**
    - **3.1/3.2:** If in doubt, use the data provided in the csv files. The csv data is the data that the solution is based off of.
    - **3.1/3.2:** You can solve this however you want. However, without using the raw data, your answer may not be as accurate.
    - **3.1/3.2:** We are only interested in the relative amplitude reduction factor.
        - Specifically, if the amplitude gets reduced to 0.5 from 1, the reduction factor is 0.5.

General Notes

- Aperture pattern is referring to the pattern of the slits
- Many students have expressed concern about not knowing fourier transforms. You will receive partial marks if you do not use those, though skimming through the Wikipedia pages should give you the relevant background information.

Other Notes

- You are allowed to refer to Wikipedia (but not any other sources). You should typically rederive proofs instead of citing them.
- Uploading images: View this link to find how to upload images on overleaf.

- You are allowed to mix LaTeX and handwritten PDFs for your answer sheet. Note that you need to write your solution to the problem alongside your final answers. If you desire a LaTeX template, we have made one for you here. Make a copy of the project to edit the document.
- You can use basic formulae related to topics on the IPhO syllabus (+ the linked wikipedia pages) without derivation but all other formulae which go beyond that must be derived.
- If you find that space is running out on your LaTeX file, try to use `\newpage` and see if that fixes it.