OPT211 Final Project Spring 2024

Technical Memorandum 1:
Aperture Dimensions and Example Output

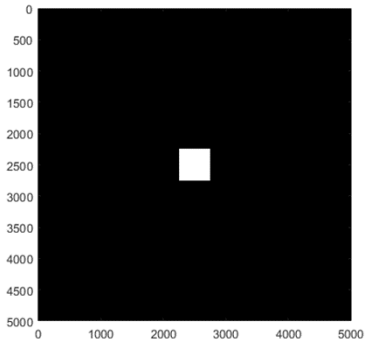
Part 1: Aperture Assignments and Dimensions

Please utilize the following dimensions for your first test aperture. The aperture size assumes an aperture field of 5000x5000 pixels. If you cannot successfully run your script at this aperture field size, please contact me and we will discuss a workaround solution.

Your team will produce nearly lab-accurate simulations of far-field diffraction patterns from eight to ten different apertures. Every group is required to create the five apertures described in this section of the tech memo. Additionally, you propose an additional three to five apertures you will simulate. Your cohort TA and/or Greg must approve these apertures. They will help you assess the relative difficulty of producing your proposed apertures and provide suggested apertures if your team gets stuck.

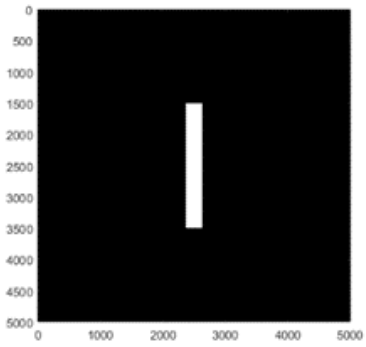
These are the five apertures you must simulate. If you have designed your script to accept any aperture dimensions, please include the output describing the following five test aperture sizes in your final report:

The Square Aperture:



Side length of 500 pixels

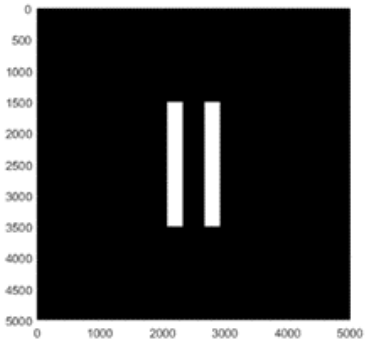
The Single Slit Aperture:



Slit width of 200 pixels

Slit height of 2500 pixels

Double Slit Aperture:

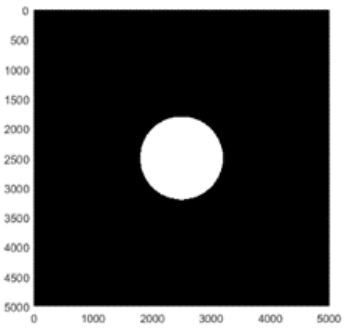


Slit width of 175 pixels (for each slit)

Slit height of 2500 pixels (for each slit)

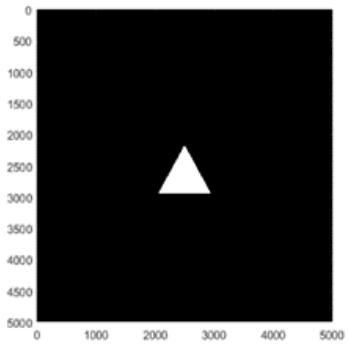
Slit spacing of 500 pixels (slit center-to-center)

The Circular Aperture:



Aperture radius of 275 pixels

The Equilateral Triangle:



Side length of 900 pixels (3 sides equal length)

Part 2: Example Diffraction Pattern

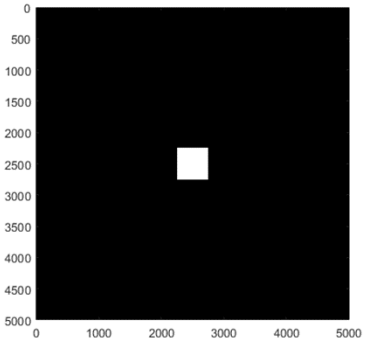
The following images represent accurate output from the square aperture. Strive to recreate these plots and similar plots for the other apertures.

You must create plots which show:

1- The aperture field in full 5000x5000 pixels
2- The scaled far-field diffraction pattern in full 5000x5000 pixels
3- The scaled far-field diffraction pattern encompassing just the center 250x250 pixels
4- All relevant intensity cross sections of the diffraction pattern

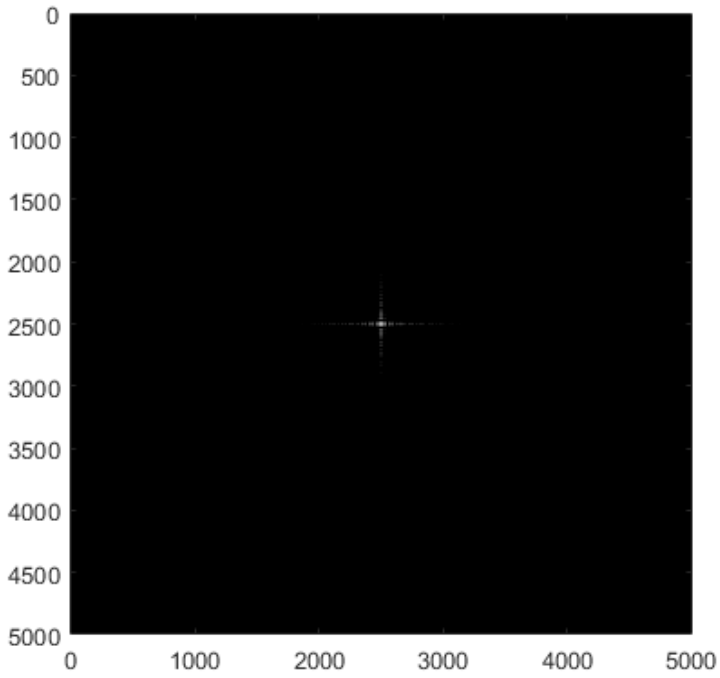
NOTE: The following plots are unformatted. They represent just the raw output. It is up to you to make them presentation quality and include colorbars, legends, titles, axis labels, etc. as relevant.

The Square Aperture:

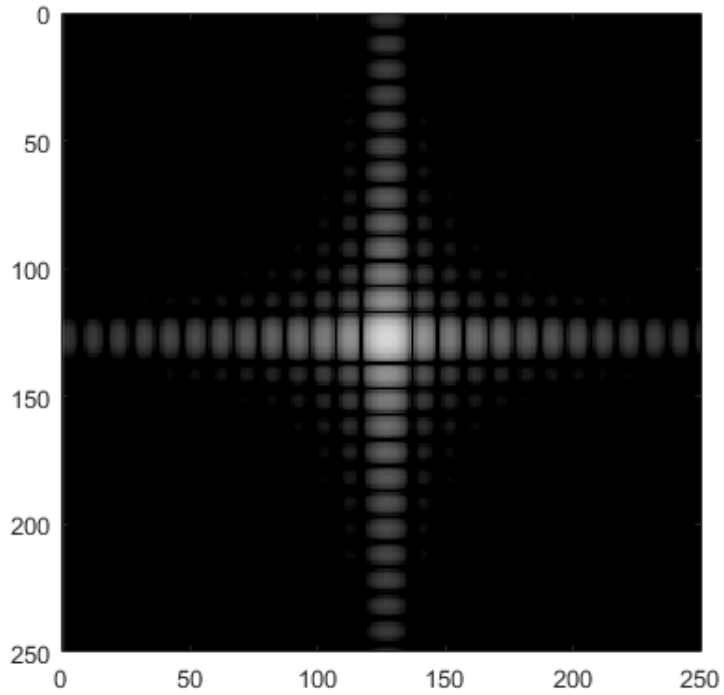


Side length of 500 pixels

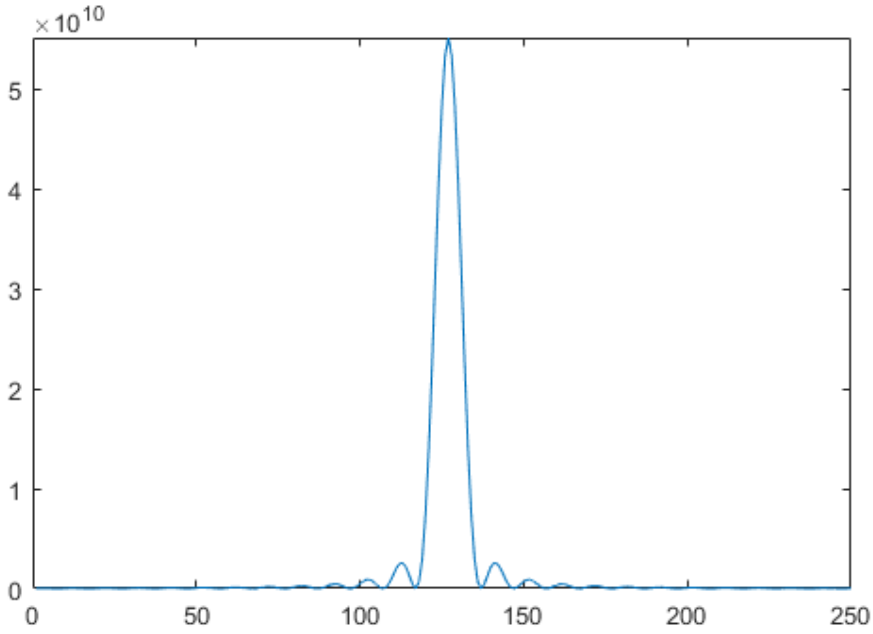
Full-Field Far Field Diffraction Pattern:

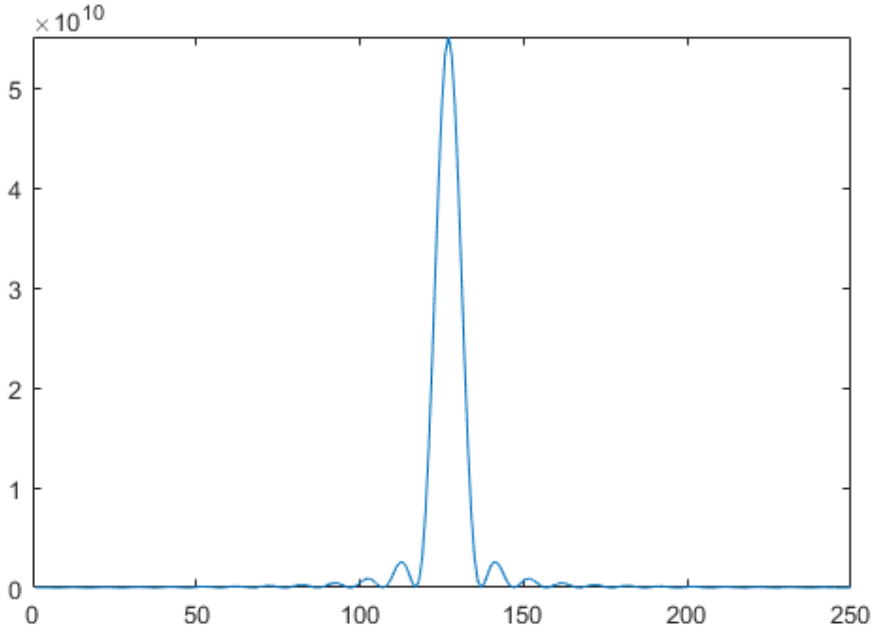


Center-Field Far Field Diffraction Pattern:



Intensity Cross Sections:





Part 3: Final Script and Report Requirements

Your script and all plots/images you produce must be properly labelled and commented. The script should have a header and help file. The images and plots should be presentation quality. Your script should not generate any command window output (unless critical to the running of the script), error messages, or warnings (graphics warnings are out of your control and are okay).

Your final report should include:

1- *Introduction:* What is the basic premise of the project? What scientific purpose does it serve? (One short paragraph is fine)
2- *Script Description:* As a bulleted list, briefly describe how the script works and what each section does (One to two pages)
3- *Results:* Include copies of script output for each aperture.
4- *Discussion and Conclusions:* What do the results tell you about diffraction? Can you gain any insight from the diffraction patterns you create? Did you make any interesting observations while you were working on the project? (One to two paragraphs is fine)
5- *Appendix 1:* A copy of your script (proper font and colors as it displays in Matlab)

Although this description may seem formal, keep the report short, concise, and to the point. Each written section should be kept to no more than a few short paragraphs or a bulleted list as described above. The purpose of the report is to gauge how well you understand what you did and why you did it. It will also gauge how well you learned the lessons outlined in the labs as far as complete and responsible scientific work in Matlab.

Please save the final report as a PDF file. Each group will submit a single project script (or set of scripts if that is how you set up your program) and a single report to Greg by 8:00AM, Wednesday, May 8 (*via Slack*).

Each group will reserve a short interview time during finals week. The interview is informal. You need not dress up for it or prepare a presentation. We will run the script you submitted, talk about your group, the project, and the class as a whole. If you wish to complete the interview before the final exam period please let Greg know. This is appreciated but not required.

Each member of each team will be required to submit an online self-assessment survey and assessment survey for each additional team member. These assessments will determine the individual component of the project grade.

If you have any additional questions, please contact Greg.