Graded Practice 1
Astroinformatics I

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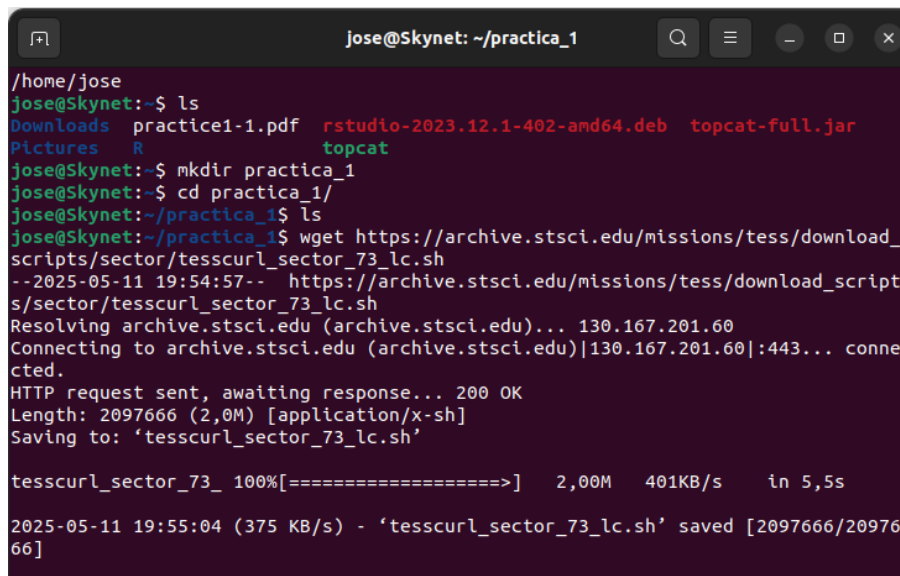
A   Introduction

For the completion of this practice, tutorials 2 and 3 provided during the course were used as references [Hernitschek, 2025a,b]. All the work was carried out in a Linux environment using the Ubuntu 22.04 LTS platform[1]. Additionally, to install the TOPCAT software, the procedure indicated on the GNU Astronomy Utilities website was followed[2]. Likewise, the writing of this practice was done in LaTeX, using the Overleaf platform[3].

B   Practice Development

Problem 1

The first objective was to download the script `tesscurl_sector_73_lc.sh` from the website https://archive.stsci.edu/tess/bulk_downloads/bulk_downloads_ffi-tp-lc-dv.html.

To do this, a terminal was opened and a folder named "practica_1" was created. The command `cd` was used to enter this folder, and the file was downloaded using the `wget` command. The procedure is shown in Figure 1.

Figure 1: Procedure for downloading the script.

To execute the script, the location of Bash in Ubuntu was verified using the command `which bash`, which returned the path `/usr/bin/bash`. Then, the `vi` command was used to insert this path in the first line of the script. The `chmod +x` command was used to grant execution permissions to the script. Finally, the script was executed using the command `./tesscurl_sector_73_lc.sh`.

When 15 files had been downloaded, the process was stopped using the "CTRL+C" keyboard shortcut. The entire procedure is shown in Figure 2.

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[1] Available at https://releases.ubuntu.com/jammy/

[2] GNU Astronomy Utilities is available at https://www.gnu.org/software/gnuastro/manual/html_node/TOPCAT.html

[3] Available at https://www.overleaf.com/

Figure 2: Steps for executing the script.

Figure 3 shows a list of the downloaded files as well as the file count.

Figure 3: Downloaded FITS files.

Problem 2

To convert the format of the 15 files from FITS to CSV, the TOPCAT software was used. To run TOPCAT, the command `./topcat` was executed.

The procedure was carried out individually for each file. First, the FITS file was opened, as shown in Figure 4.

Then, the same file was saved in CSV format, as shown in Figure 5. This procedure was repeated for all 15 FITS files. A view of the generated CSV files is shown in Figure 6.
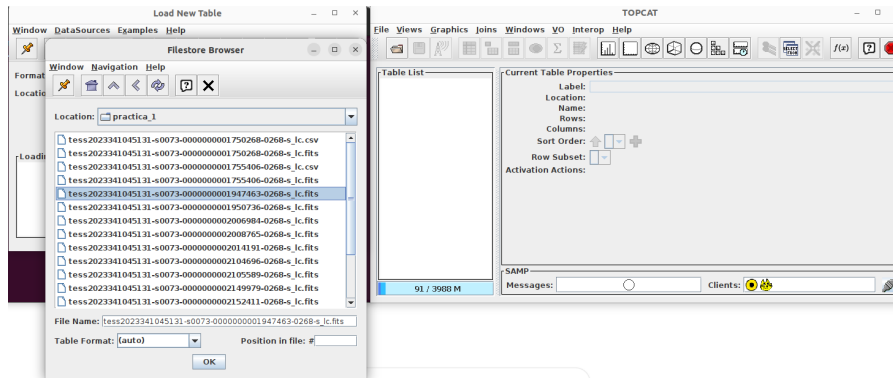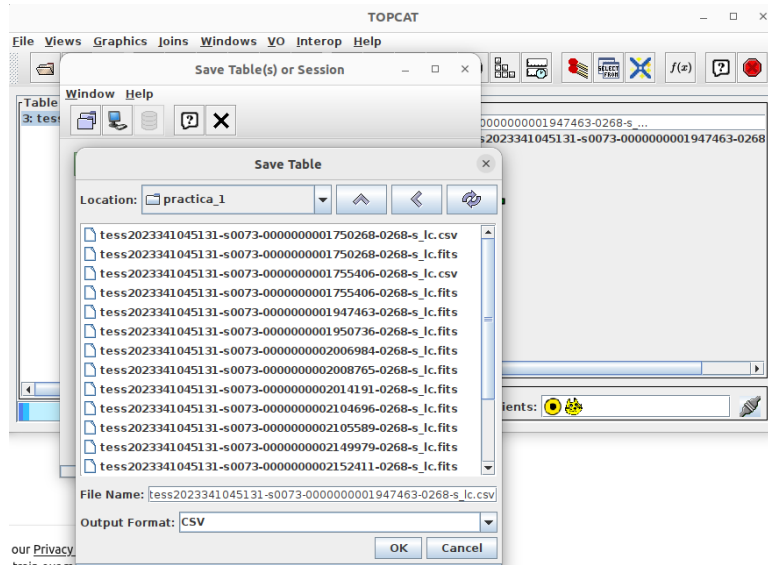
Figure 4: Opening the FITS file.
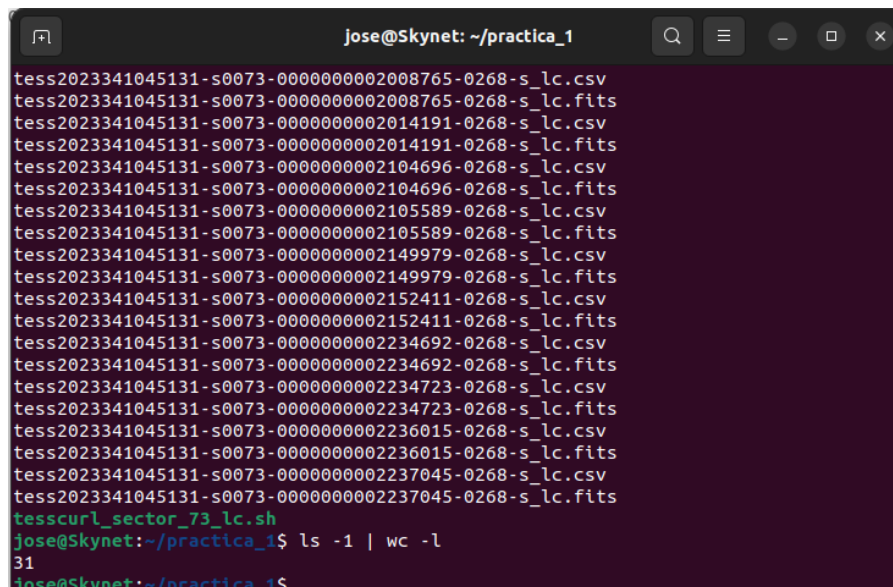

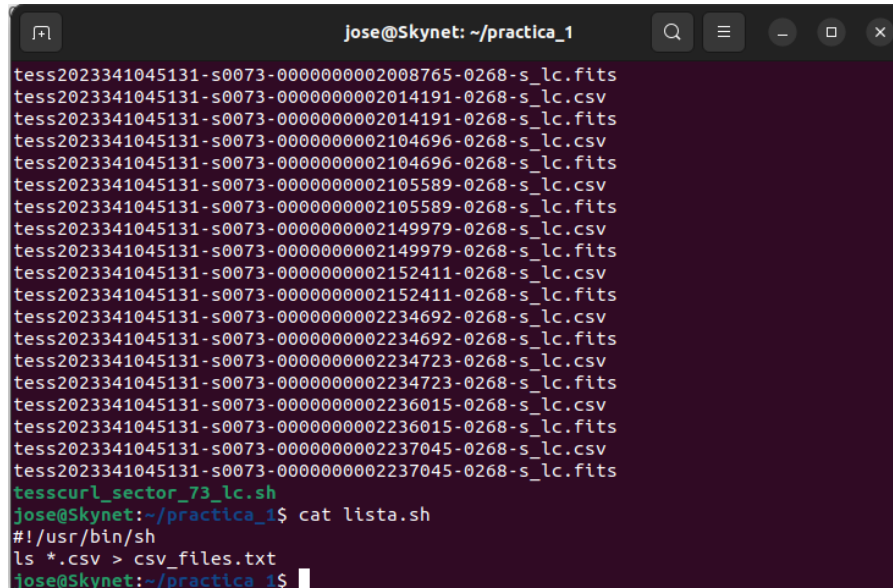Figure 5: Saving the file in CSV format.
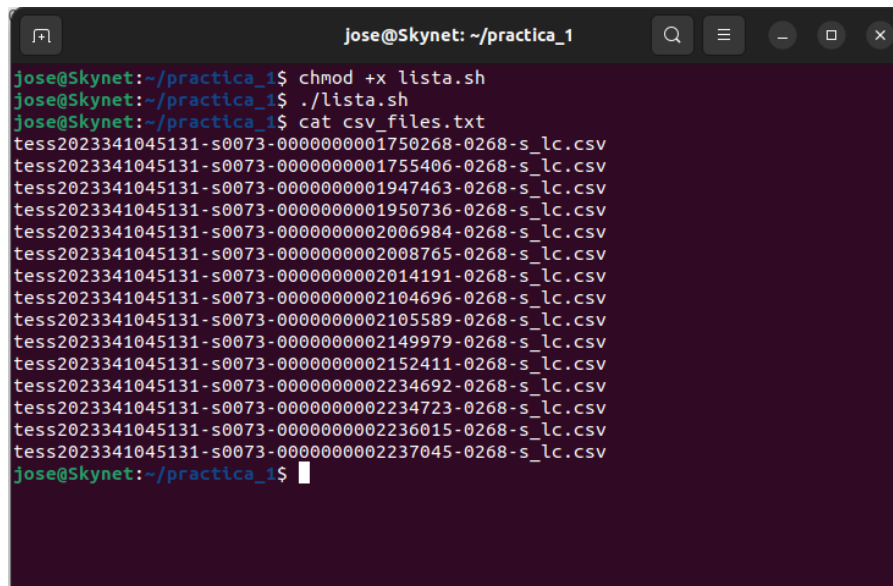

Figure 6: List of CSV files.

Problem 3

A script named `lista.sh` was written to list all the CSV file names, exporting them into a text file called `csv_files.txt`. The content of the script is shown in Figure 7.

Figure 7: Script that lists CSV files.

Figure 8 shows the content of the generated text file.

Figure 8: Content of the `csv_files.txt` file.

Problem 4

A script named `dividir.sh` was written to split the file `csv_files.txt` into 3 text files. Each text file contains the names of 5 elements from the original list (`csv_files.txt`). Figure 9 shows the content of the script as well as its execution.

Figure 9: Execution of the script that splits the `csv_files.txt` file.

Problem 5

In this step, each CSV file was plotted. For this, TOPCAT was used: each file was opened, and the columns `TIME` and `PDCSAP_FLUX` were selected for the horizontal and vertical axes, respectively. Each graph was then saved in PDF format. The procedure is shown in Figure 10.
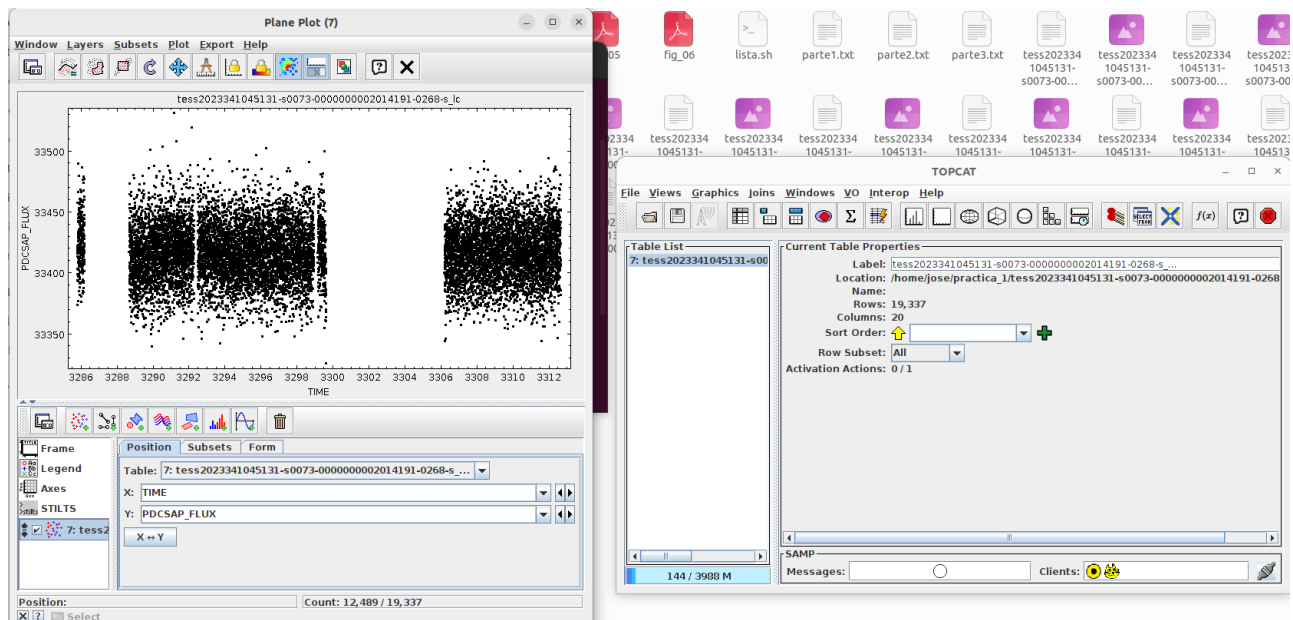
Figure 10: Plotting each CSV file.

The resulting plots are shown in Figure 11.
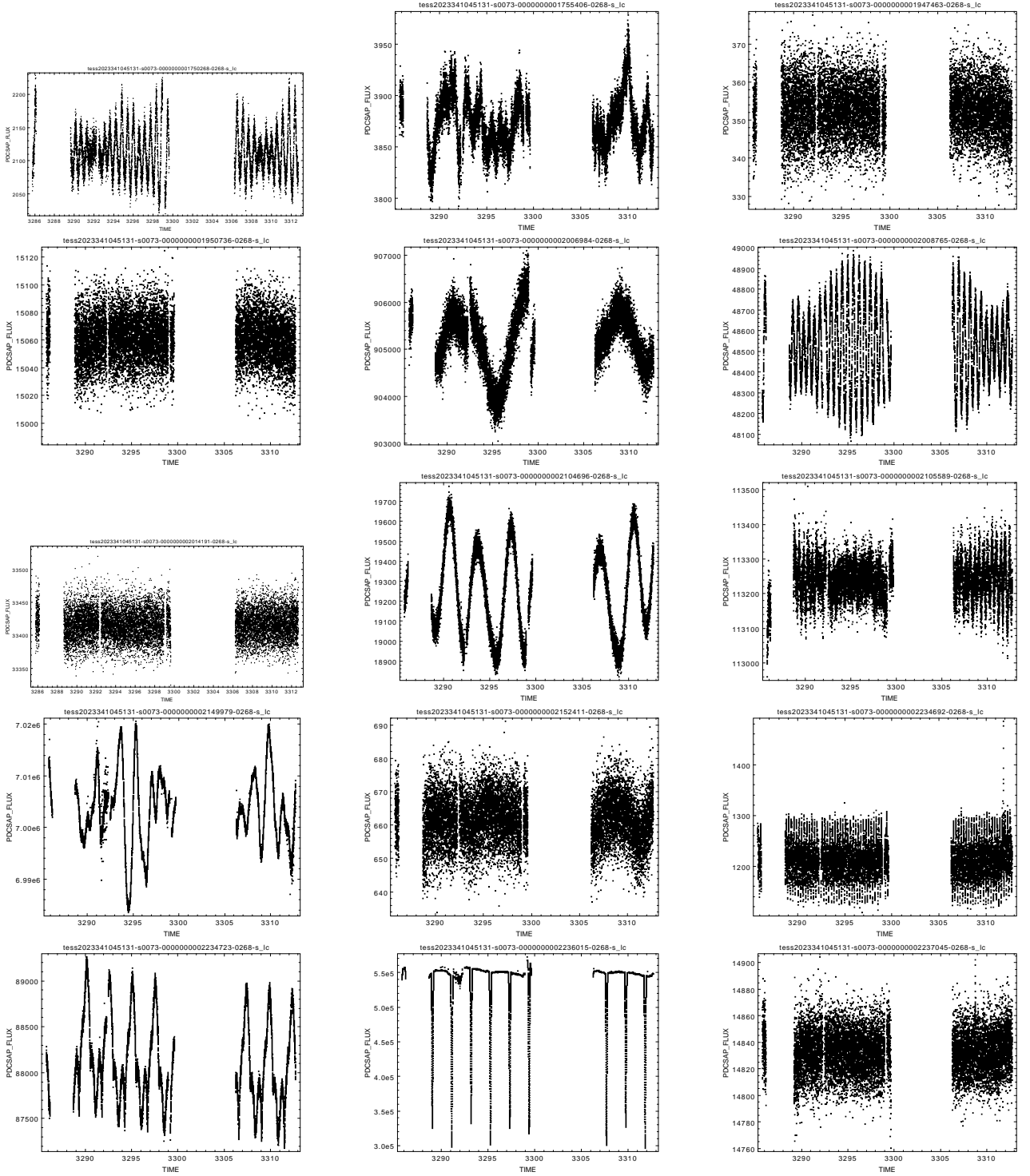
Figure 11: Set of 15 generated plots.

C   Problems and Solutions Encountered

- One problem encountered was the need to modify the Bash path in the file `tesscurl_sector_73_lc.sh`, as the script would not run otherwise. The `which` command was used to find the correct Bash location.

- Another issue was that the script uses the `curl` command. The solution was to install this tool using `sudo apt-get install curl`.

- Batch conversion from FITS to CSV was attempted but not possible. Therefore, the format had to be changed individually for each file.

- It was also noted that TOPCAT does not automatically append the `.csv` extension to files. While this did not cause issues within TOPCAT, it could lead to problems when opening files with other programs. As a result, the extension was added manually to each file name.

- Additionally, saving the light curve plots in PNG format resulted in poor image quality. However, saving them in PDF format significantly improved the quality.

References

N. Hernitschek. Tutorial 2. https://github.com/ninahernitschek/astroinformatica_I_2025_1/blob/main/tutorial2.pdf, 2025a. PDF available on GitHub.

N. Hernitschek. Tutorial 3. https://github.com/ninahernitschek/astroinformatica_I_2025_1/blob/main/tutorial3.pdf, 2025b. PDF available on GitHub.