2024 Sagan Summer Workshop

Advances in Direct Imaging: From Young Jupiters to Habitable Earths

Getting Started Guide: Google Colab

For the workshop hands-on sessions, the notebooks have been designed to run in Google Colaboratory. Users can download them and run them as Python Jupyter notebooks (there are embedded instructions for Python usage), but only Google Colaboratory is fully supported. In addition to following these instructions, please also run the Setup notebook(s) for the hands-on sessions you will be participating in.

Google Colaboratory allows you to execute Python in a browser without configuring Python on your local system. The Python code is run from a notebook environment similar to Jupyter notebooks, with execution and text cells. For a general introduction to Colaboratory, see:

What is Colaboratory?
https://colab.research.google.com/notebooks/intro.ipynb

Overview of Colaboratory Features
https://colab.research.google.com/notebooks/basic_features_overview.ipynb

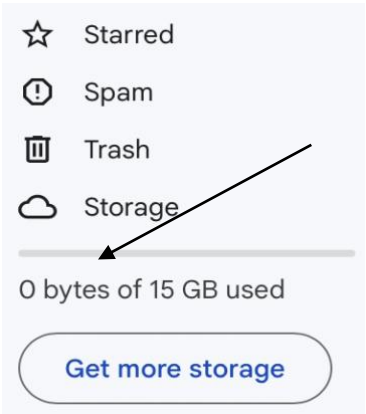
Workshop Colaboratory Instructions

You will need:

- A free Google account which includes 15GB storage. https://www.google.com/account/about/
- Having 5GB of free space should be sufficient. If you do not have 5GB available, we suggest creating a new Google account to maximize storage.

Verify that you have about 5 GB storage available:
1) Log into your Google account
2) Navigate to Google Drive by either following this link: https://drive.google.com/drive/my-drive or, from your account, click on the dot navigation and then click on the Drive icon.

3) Once in Drive, on the left side menu, there is a section called "Storage" which will show how much space you have available. If you have insufficient storage in your Google account, we suggest creating a new account rather than purchasing storage. Note that if you reach the storage limit, it will affect your email usage, so it is better to create a new account.



SSW 2024 Notebooks

[NOTE: the notebook links have been updated to their permanent archive location]

Copy the Notebooks individually to your Google Drive (see the step-by-step instructions below this section) or download the notebooks all at once and copy them into the "Colab Notebooks" directory in your Google Drive (or onto your local machine for Python Jupyter notebook usage) via the tar or zip format file.

Tar format: https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks.tar.gz
Zip format: https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks.zip

Answer notebooks:
Tar format: https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks.tar.gz
Zip format: https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks.zip

Hands-on Session I: Optical Modeling

SSW2024_HCIPy_Handout.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_HCIPy_Handout.ipynb
Note: This includes the main hands-on session exercises, as well as ideas for the group projects. There is no setup notebook for this one.

Hands-on Session I: Optical Modeling Answers

SSW2024_HCIPy_Handout_solution_manual.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks/SSW2024_HCIPy_Handout_solution_manual.ipynb
Note: This includes answers for the main hands-on session exercises only.

Hands-on Session II: PSF Subtraction

SSW2024_PSF_Subtraction_Setup.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_PSF_Subtraction_Setup.ipynb
Note: This needs to be run only **once** *and applies to all three notebooks below.*

SSW2024_ImagingExoplanets.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_ImagingExoplanets.ipynb
Note: This includes the main hands-on session exercises, as well as ideas for the group projects.

SSW2024_OrbitFitting.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_OrbitFitting.ipynb
Note: This is used for one of the group projects referenced in SSW2024_ImagingExoplanets.ipynb.

SSW2024_PlanetIsochones.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_PlanetIsochrones.ipynb
Note: This is used for one of the group projects referenced in SSW2024_ImagingExoplanets.ipynb.

Hands-on Session II: Group Project Answers

Project 1:
The entire solution is in **SSW2024_ImagingExoplanets-Answers_1_4.ipynb**, under the project 1 section.

SSW2024_ImagingExoplanets-Answers_1_4.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks/SSW2024_ImagingExoplanets-Answers_1_4.ipynb

Project 2:
The entire solution is in **SSW2024_ImagingExoplanets-Answers_2.ipynb**.

SSW2024_ImagingExoplanets-Answers_2.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks/SSW2024_ImagingExoplanets-Answers_2.ipynb

Project 3:
The solution is a combination of **SSW2024_ImagingExoplanets-Answers_3.ipynb** (the first step), and **SSW2024_PlanetIsochones-Answers.ipynb** (the second step, you have to take the flux ratio measured in the first step and plug it into the second step).

SW2024_ImagingExoplanets-Answers_3.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks/SSW2024_ImagingExoplanets-Answers_3.ipynb

SSW2024_PlanetIsochrones-Answers.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks/SSW2024_PlanetIsochones-Answers.ipynb

Project 4:
The first step is in **SSW2024_ImagingExoplanets-Answers_1_4.ipynb** (measure the planet astrometry for both images). The second step is in **SSW2024_OrbitFitting-Answers.ipynb.** The first part of the orbit fitting notebook is putting the values of the planet astrometry into a csv file (**SSW2024_HR8799c_astrom_answer.csv** shows what that should look like) before running the orbit fitting code.

SSW2024_ImagingExoplanets-Answers_1_4.ipynb

https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks/SSW2024_ImagingExoplanets-Answers_1_4.ipynb

SSW2024_OrbitFitting-Answers.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_answer_notebooks/SSW2024_OrbitFitting-Answers.ipynb

SSW2024_HR8799c_astrom_answer.csv
(Note the OrbitFitting notebook will download this file.)
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_HR8799c_astrom_answer.csv

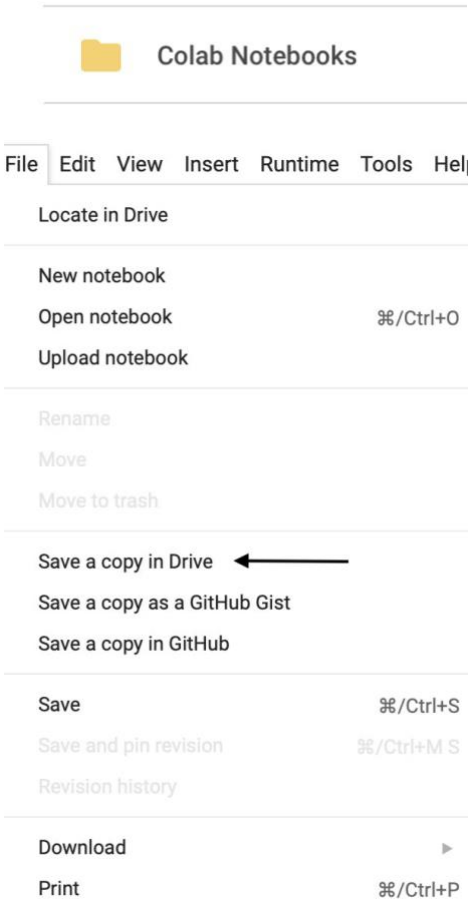
Hands-on Session III: Yield Modeling and Mission Optimization

SSW2024_YieldModelingTutorial1_Setup.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_YieldModelingTutorial1_Setup.ipynb
Note: This needs to be run only **once** *and applies to both notebooks below.*

SSW2024_YieldModelingTutorial1.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_YieldModelingTutorial1.ipynb

SSW2024_YieldModelingGroupProjects.ipynb
https://catcopy.ipac.caltech.edu/ssw2024/hands-on/SSW2024_notebooks/SSW2024_YieldModelingGroupProjects.ipynb
Note: This is used for the group project.

Steps to copy the Notebooks to your Google Drive:



1) Log into your Google account with the available storage – make sure you have signed out of all other Google accounts if you have logged into more than one.

2) From the browser where you are logged into your Google account, enter the URL of the notebook (as shown above).

3) The notebook will open in your browser. You should see your profile/initial on the upper right side of the page. If you see “Sign in”, log into your Google account.

4) Under the name of the notebook, you will see options like “File, Edit, View” etc. Click on “File” and then select “Save a Copy in Drive” (see image on the right).

5) You will be prompted to open the notebook in a new tab or window, and the notebook name will be prefaced with "Copy of". You can rename the notebook by clicking on its name. The notebooks will be saved in your Google Drive at https://drive.google.com/drive/my-drive in a directory called "Colab Notebooks".

6) Close the notebook browser windows.

7) Repeat this process to save all the Google Colab Notebooks to your Google Drive.

Instructions for Using Colab Notebooks

Launching the Colab Notebook

1) Log into your Google account where you have saved the notebooks.
2) Go to your Google Drive: https://drive.google.com/drive/my-drive
3) Click on Colab Notebooks directory.
4) Click on the notebook you want to work on.

Running the Colab Notebook

For the hands-on activity notebooks, you should step through each cell individually by clicking on the right-facing triangle to the left of each cell (▶). Be sure to run all the initialization cells before the exercise cells. Note that some cells may be marked **Colab only** or **Python only**; run only the **Colab** ones.

Useful Colab Top Menu items

- **File** -> Save Saves the file to your Google Drive
- **File** -> Download Downloads a .ipynb (Jupyter Notebook) to your local machine
- **Edit** -> Clear all outputs Clears the output from all cells
- **Runtime** -> Run all Run all the cells. Can be run multiple times.
- **Runtime** -> Disconnect and delete runtime Disconnects and exits the runtime, resetting the notebook variables back to its original state. This action is only useful if the notebook encounters an issue. It does not affect files downloaded to your drive. To restart the notebook, use the "Reconnect" button on the right.
- **Table of contents** – accessed via the three orange horizontal lines at the top left; clicking on them shows or hides the Table of contents.
- Closing the browser window stops the Colab instance.