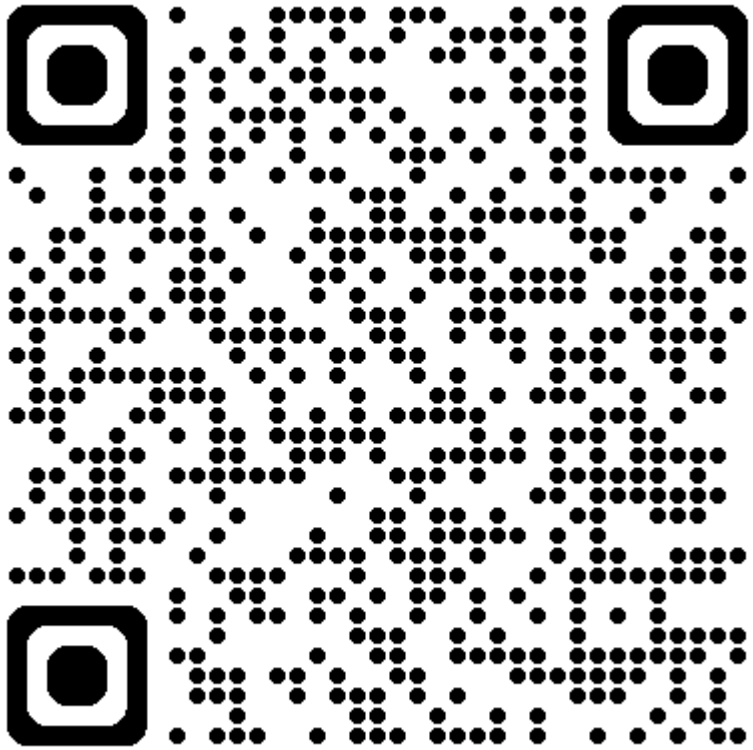
INTRODUCTION TO VISUAL STUDIO CODE FOR HPC

Before we begin, follow the QR code to take a quick survey about workshops you would like to see Research Computing run in the future:



INTRODUCTION TO VISUAL STUDIO CODE FOR HPC

Agenda

What is “VS Code?”

Using VS Code on OOD

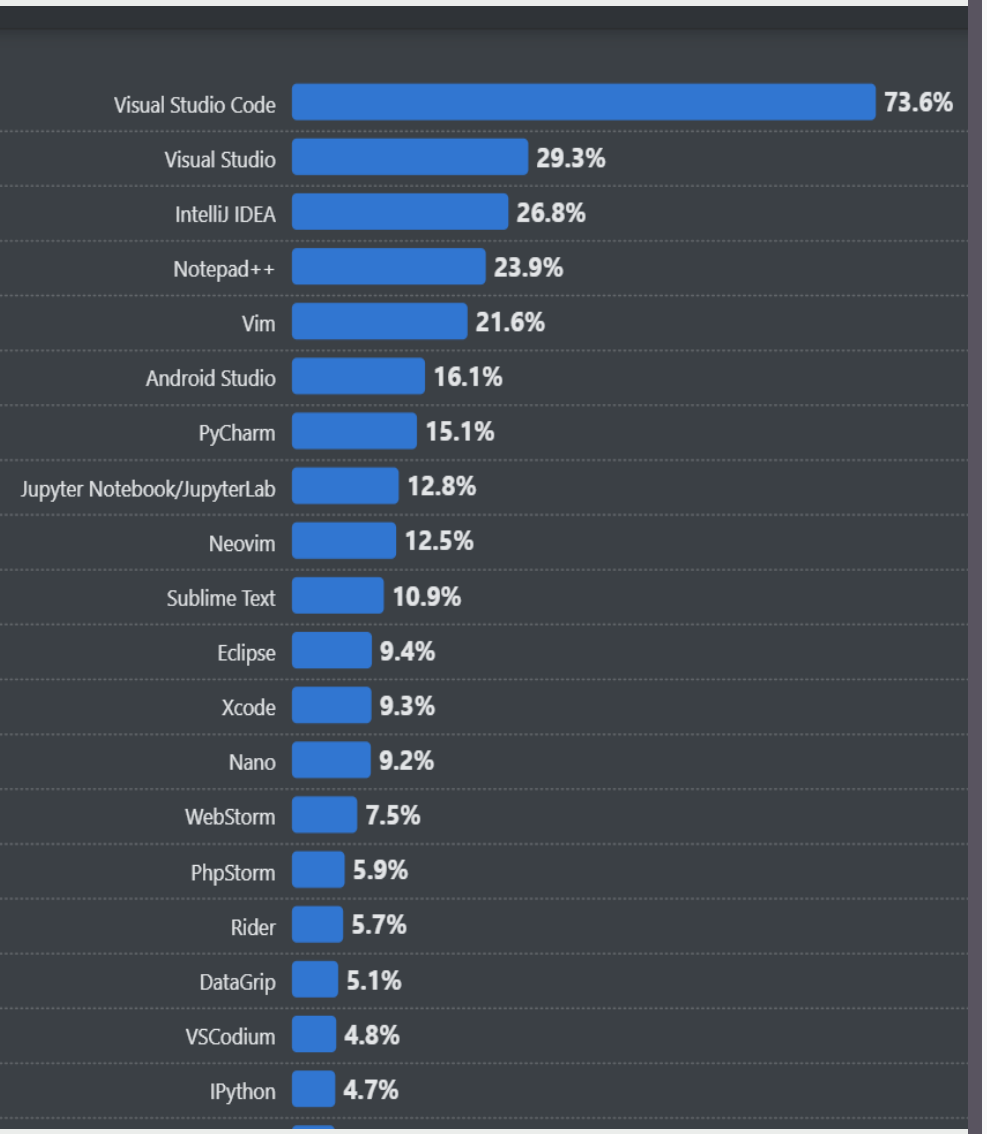
Local VS Code with HPC

Advanced Features

WHAT IS “VS CODE?”

Background

- Exists between an **Integrated Development Environment (IDE)** and a **code editor**
- **IDE:**
  - Everything needed for software development
  - Source-code editor, build automation tools, a debugger all with a GUI
- **Code editor:**
  - Lightweight, fast for writing and running code
  - May have simple debugging features
- **VS Code:**
  - Open Source, lightweight, cross-platform, fast
  - GUI, debugger
  - Extensions for extra functionality



Technology | 2024 Stack Overflow Developer Survey

Background

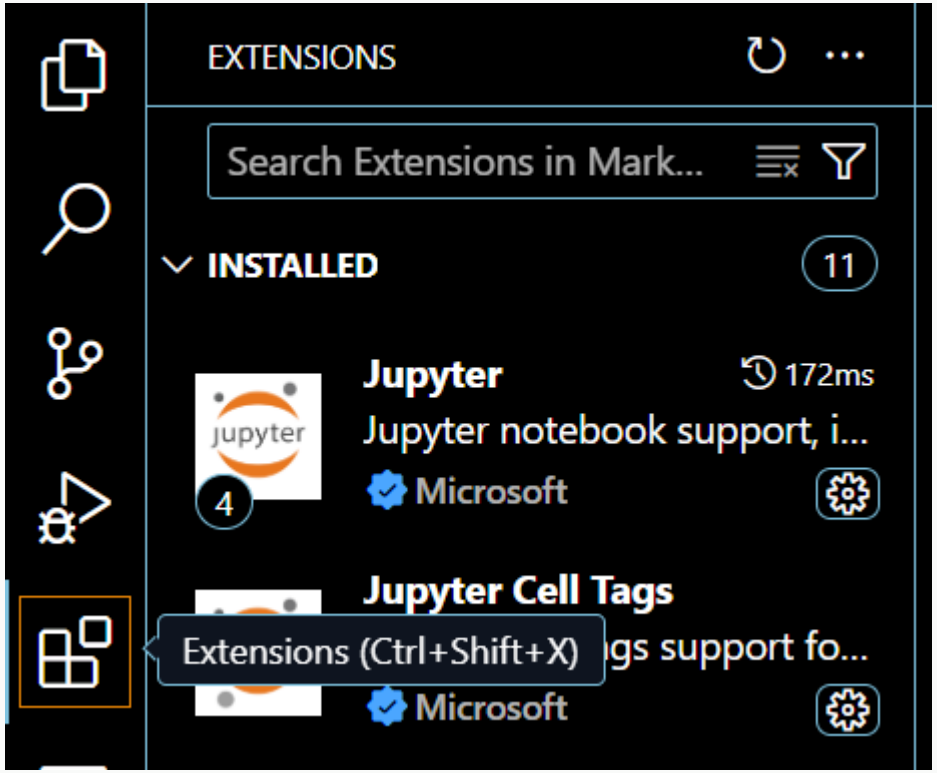
- Developed by Microsoft in **2015**
- Similar to **Visual Studio** which is a true **IDE**
  - VS Code focused on being lighter and more accessible
- Windows, Linux, macOS and web browsers
  - https://vscode.dev/
- Open-source
  - https://github.com/microsoft/vscode
- Extremely popular
  - Rated #1 on a 2024 survey, **73% of 58,000** respondents prefer VS Code

Useful Features

- Debugging
- Cross-platform
- Code refactoring
- Extensions (R, JupyterLab, Python, C, Visual extensions)
- Version Control Integration with Git
- Bracket matching
- SSH to Remote Servers
- Customization
- Built-in terminal
- Many key bind shortcuts
- Fast, light-weight

Extensions

- Extensions are available in the “marketplace”
- Common extensions are free and often updated
- https://marketplace.visualstudio.com/VSCode
- Extensions may require **software** to already be installed on your computer
  - Python, Java, etc.

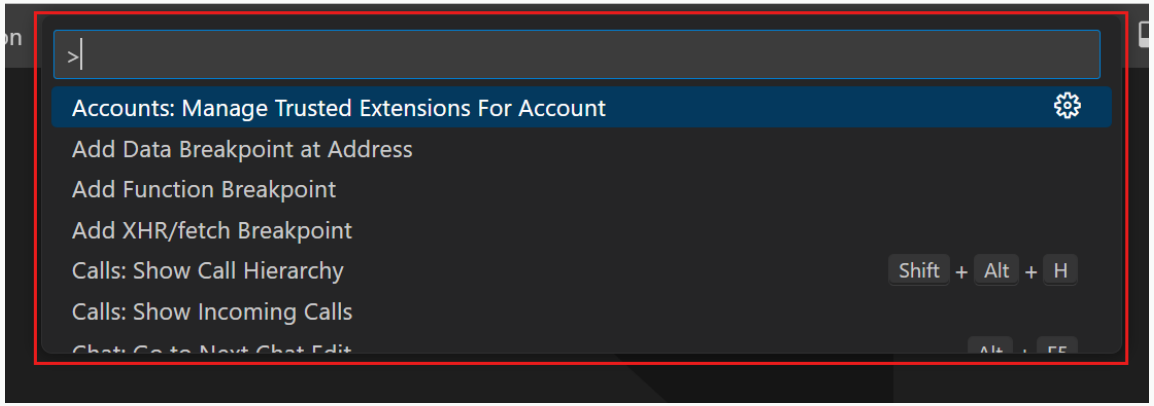


Useful Shortcuts

- **Save**
  - VSCode autosaves frequently
  - **Ctrl+ S / Ctrl+ Shift + S**
  - File > Save/Save As..
- **Run**
  - Runs your code
  - **Ctrl + F5**
  - Run > Run Without Debugging

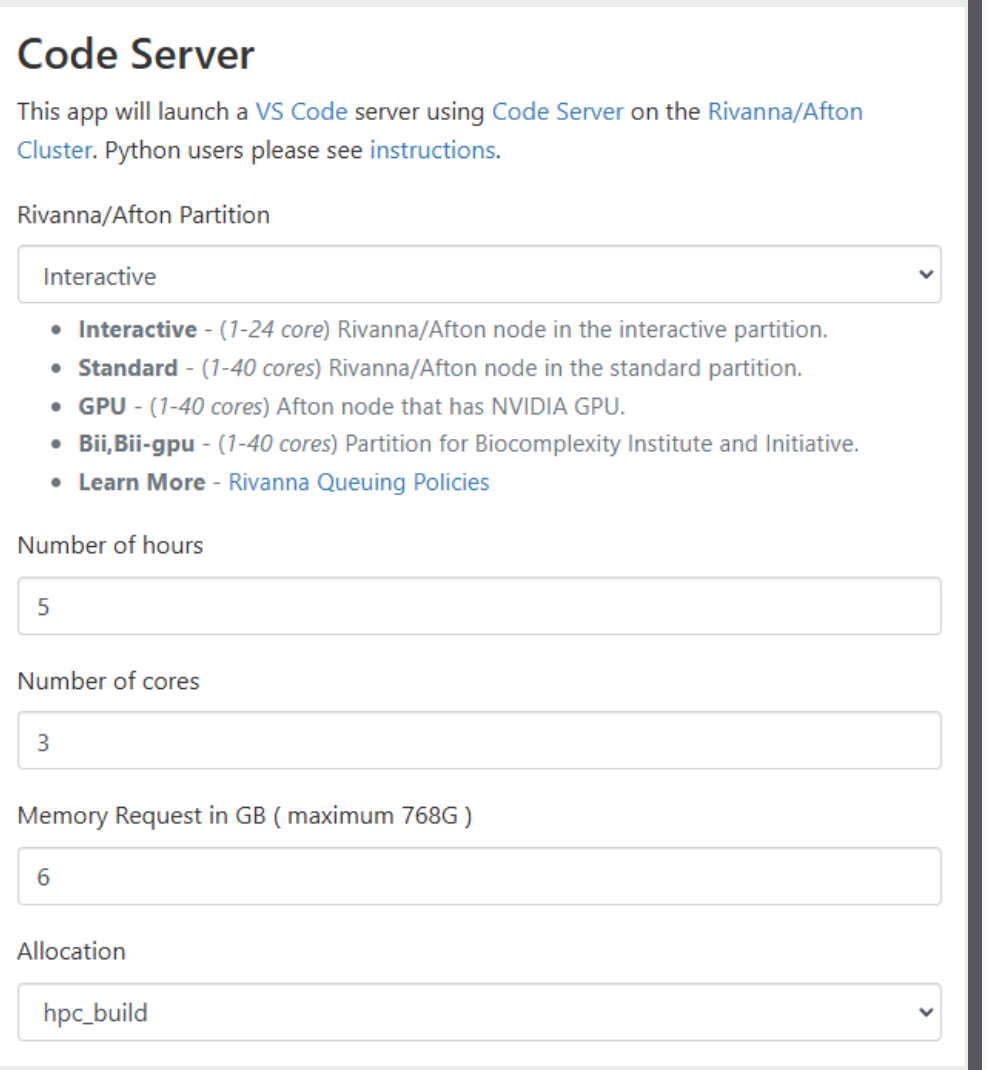
Useful Shortcuts

- **Command Palette**
  - VSCode/Extension Commands
  - **Crtl + Shift + P**
  - View > Command Palette...



- **New Window**
  - Start a new VSCode Window
  - **Crlt + Shift + N**
  - File > New Window

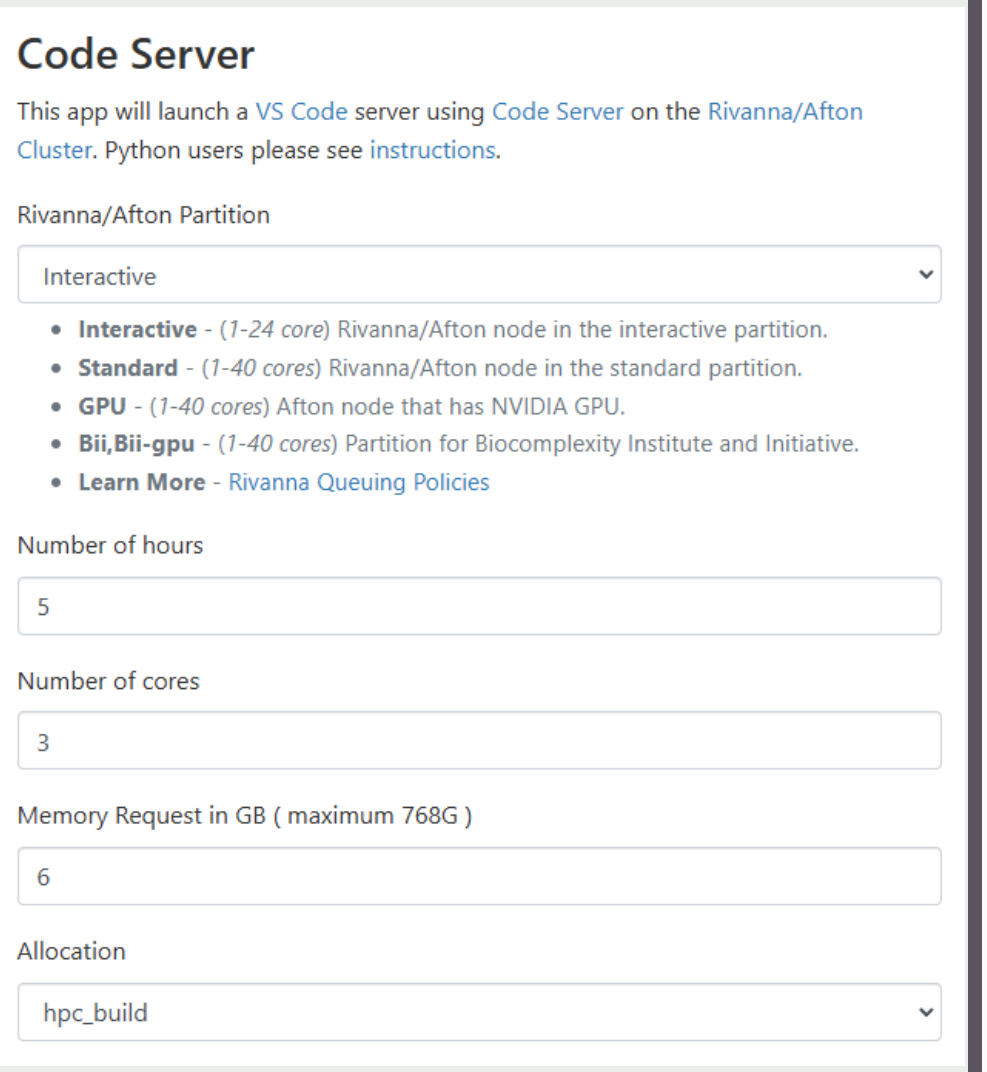
USING VSCODE ON OOD



Open on Demand

- Interactive jobs on compute nodes
- Access to your files in your HPC Account
- Access to available software modules

https://ood.hpc.virginia.edu

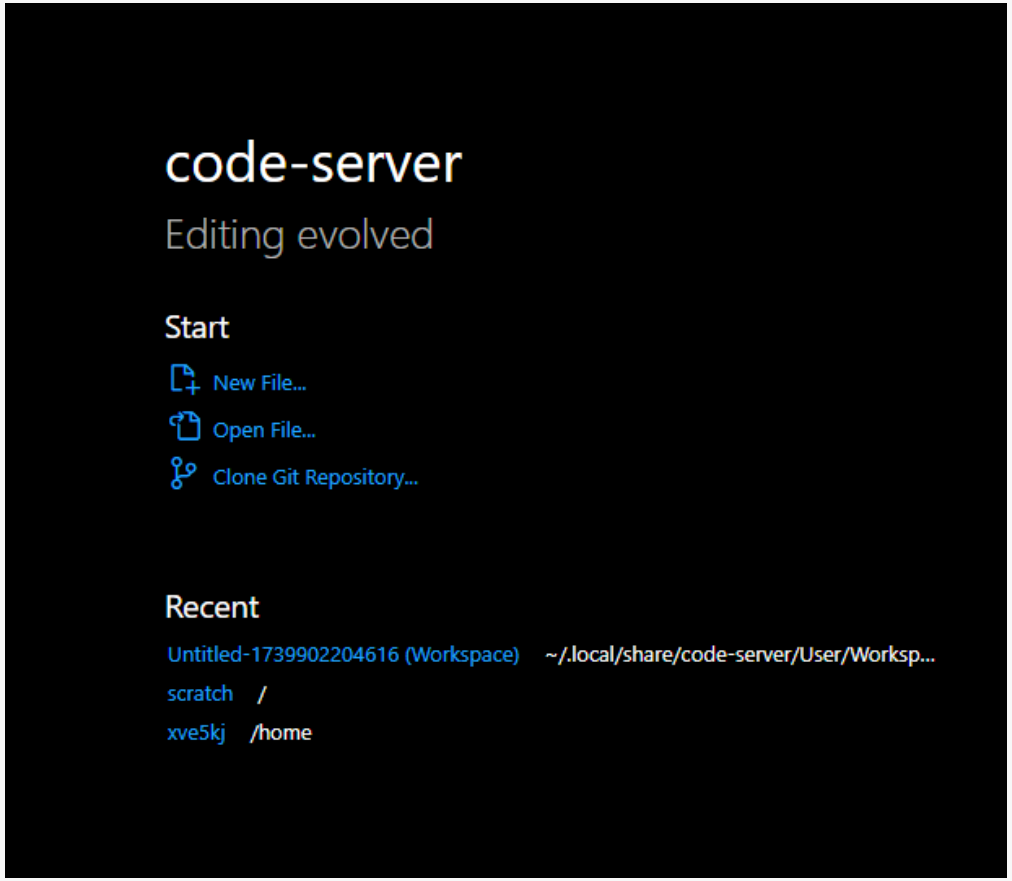


VS Code Server

- Keyboard shortcuts don't work
- Navigate just as you would on your local
- "New Window" opens a new tab
- Any changes you make on VS Code Server are on the cluster
    - They don't sync with your local
- You don't need to install software on your own computer

Getting Started...

The welcome page upon launch provides you with a variety of options to get started.

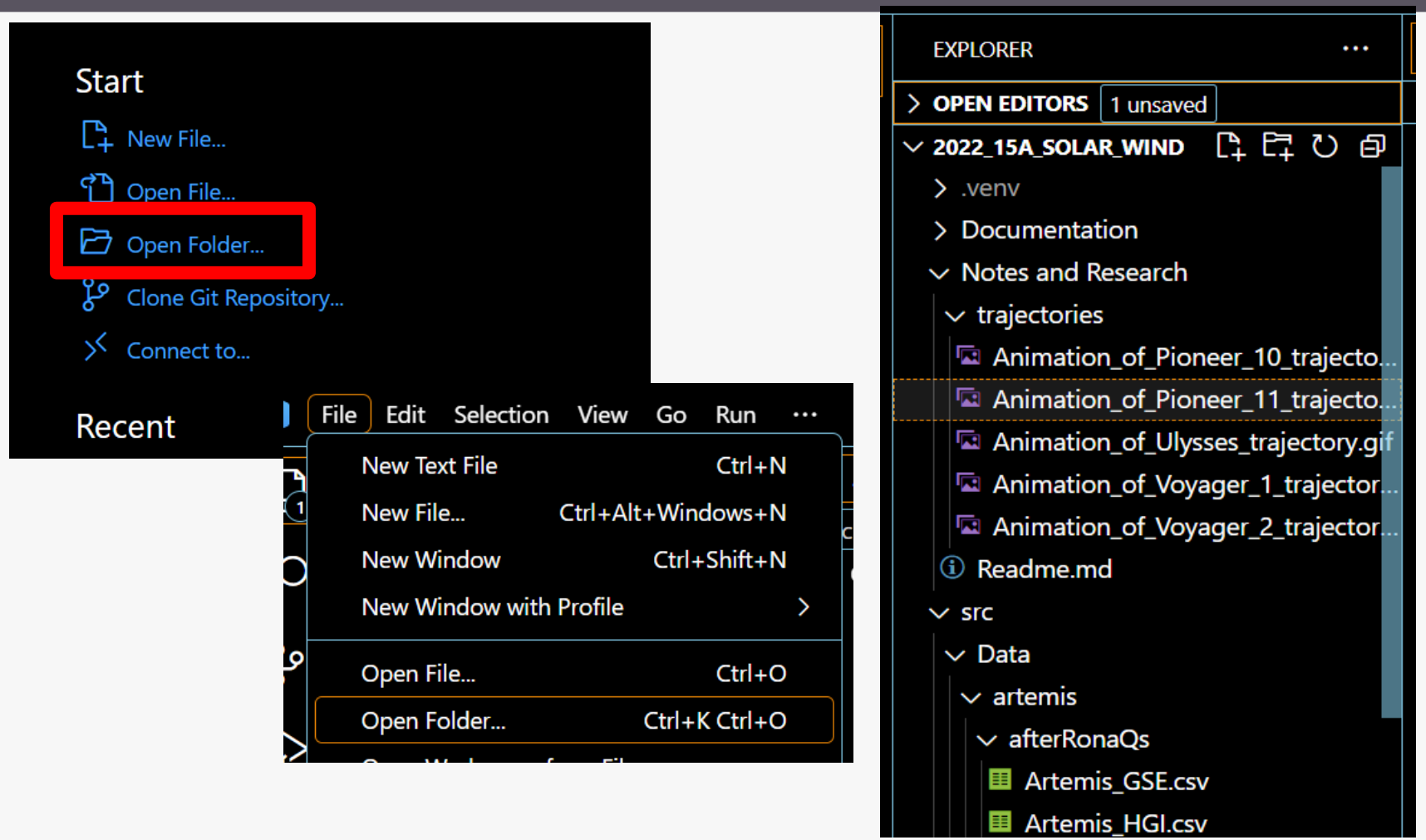


Open a Folder

Open a Folder:

Select File > Open Folder...

Appears in the explorer for easy navigation

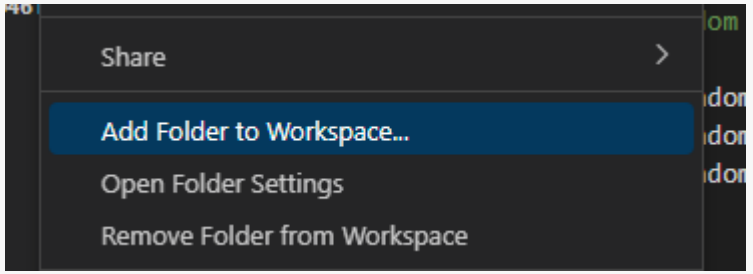


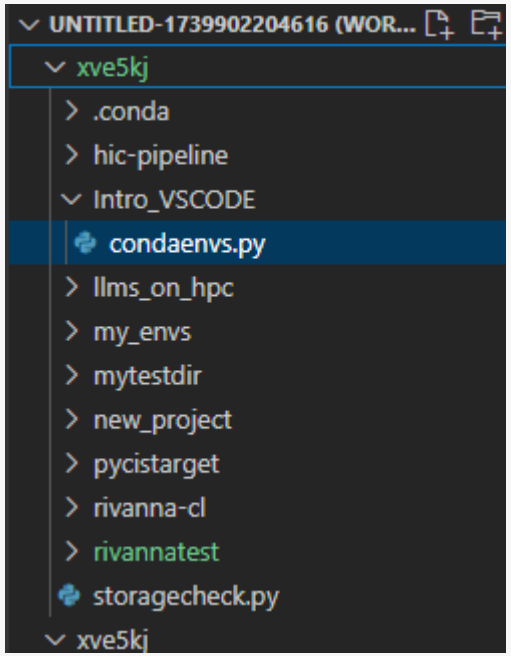
Add a Folder

Add a Folder:

Select File > Add a Folder to Workspace...

Appears in the explorer for easy navigation





Workspaces

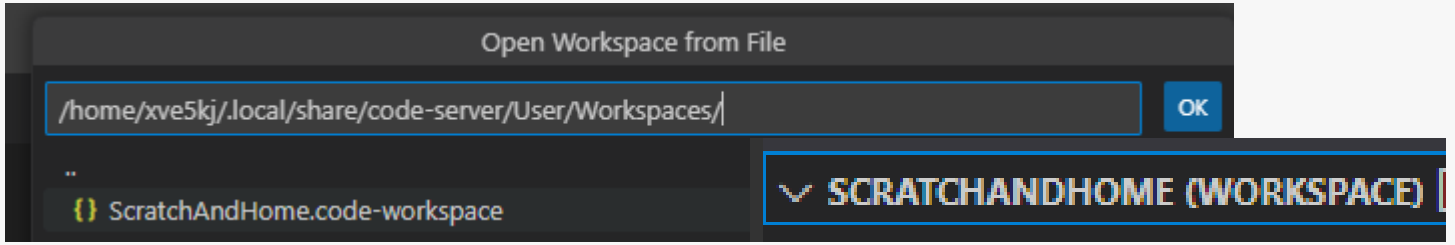
Save a Workspace:

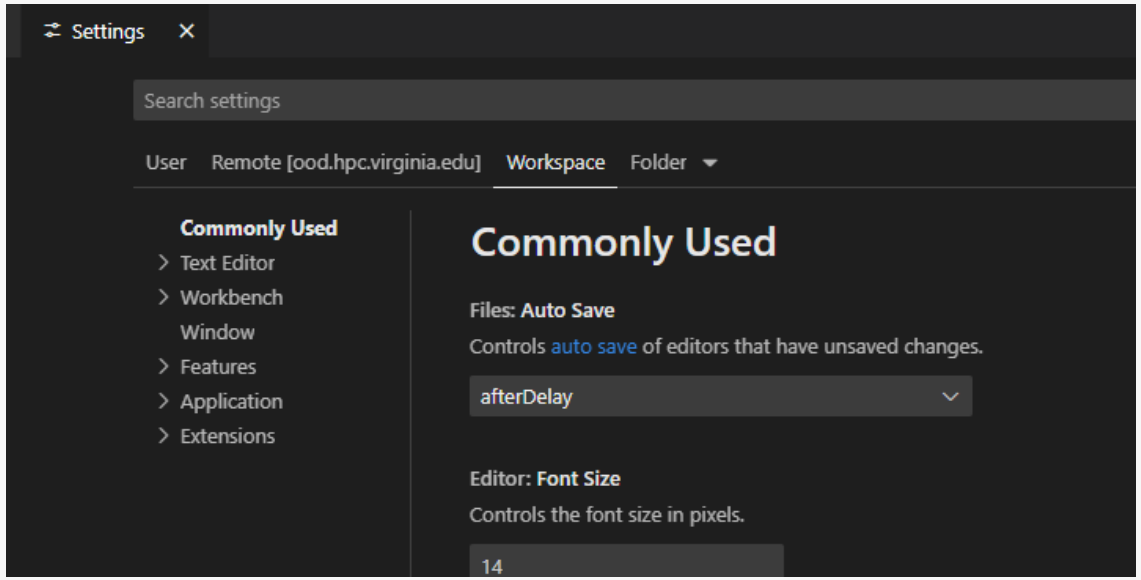
Select File > Save Workspace As

Open a Workspace:

Select File > Open Workspace from File...

Workspaces are configurations of your files and folders, so it can easily let you access your project configurations. You can even modify specific settings!





Installing Extensions

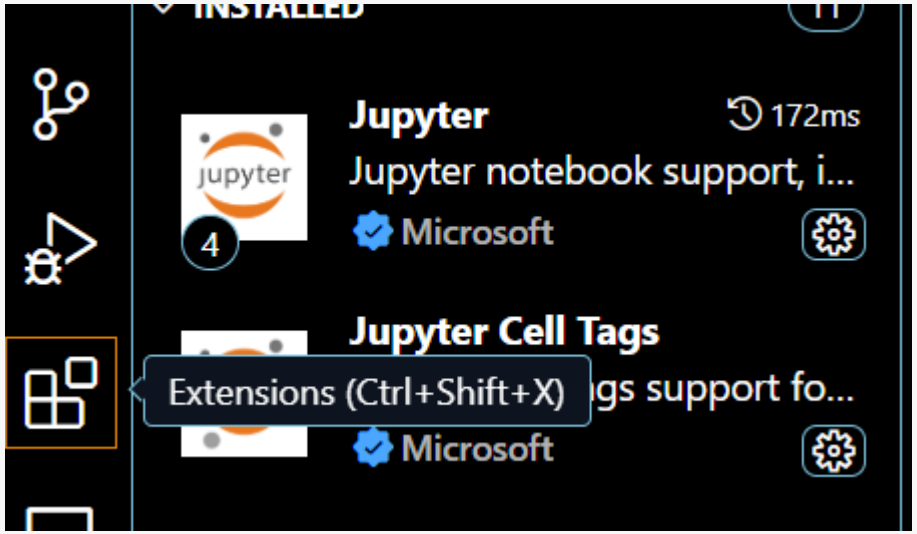
Install Extensions:

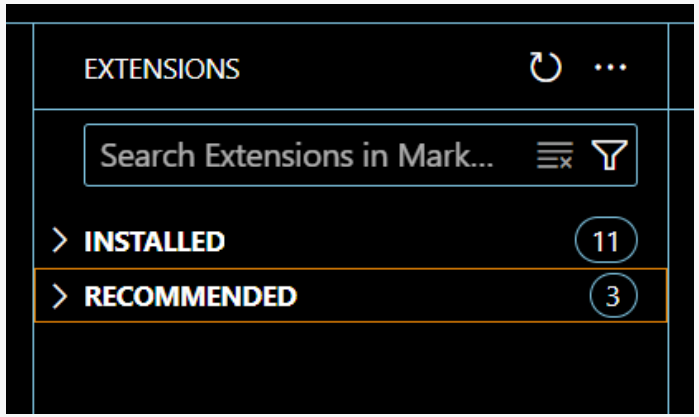
Access the marketplace in your web browser

Or the extensions tab in VS Code

(crtl + shift + x)

Install Python and Jupyter





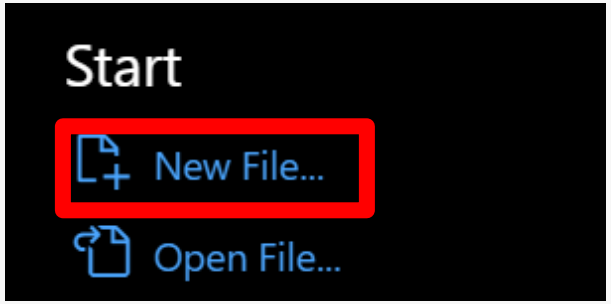
Creating a New File

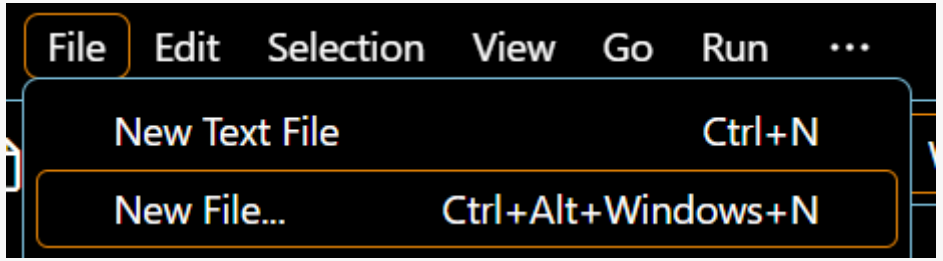
Create a File:

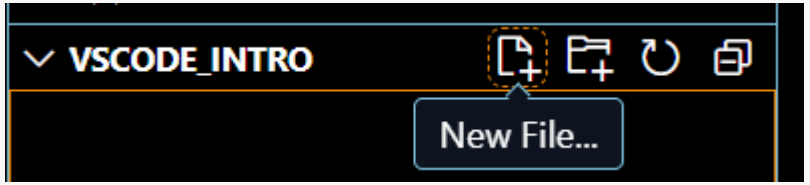
File > New File...

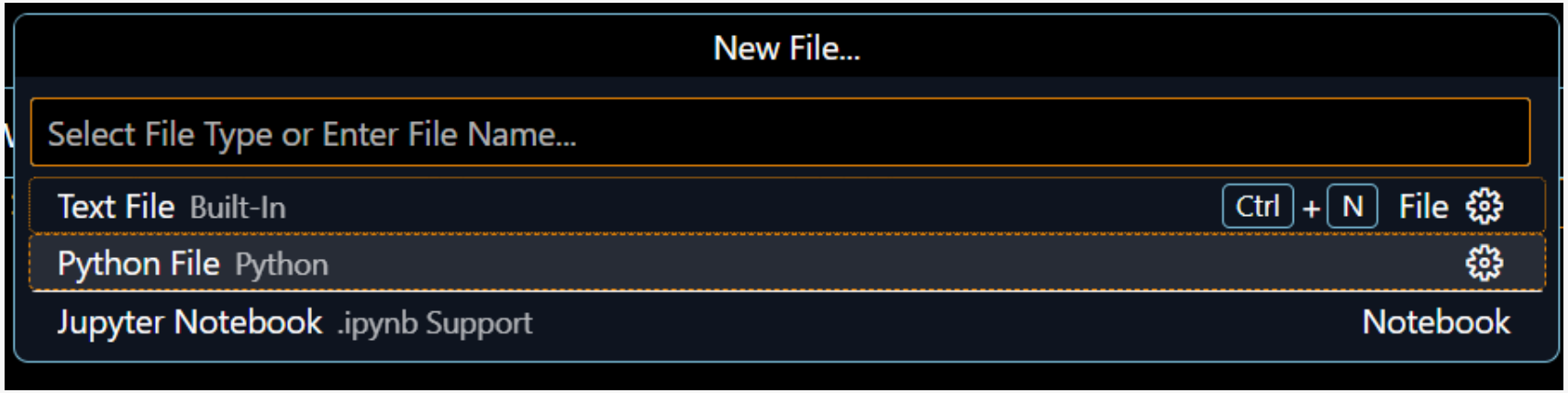
Select your file type

Make sure it is in the right folder, or move it to the correct folder in the file explorer on the left



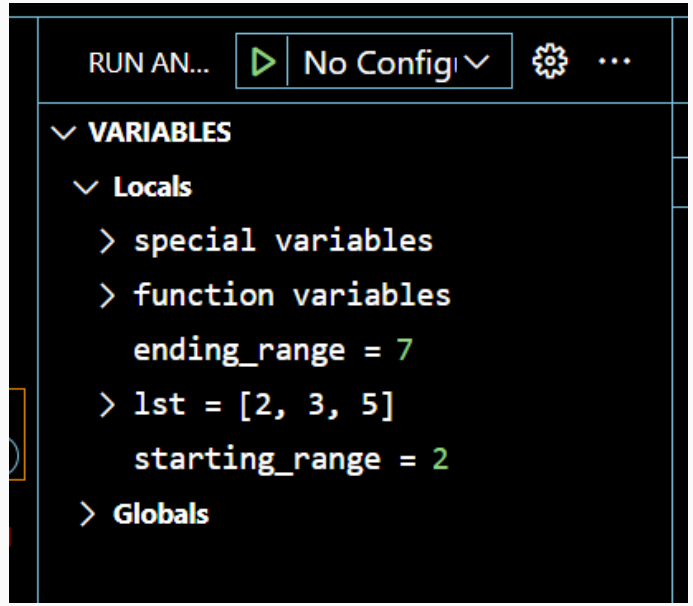






Debugging

- VSCode lets you debug without modifying your code
- Add breakpoints and view variables be updated as the code runs



Debugging

Action	Explanation
Continue / Pause F5	**Continue**: Resume normal program/script execution (up to the next breakpoint). **Pause**: Inspect code executing at the current line and debug line-by-line.
Step Over F10	Execute the next method as a single command without inspecting or following its component steps.
Step Into F11	Enter the next method to follow its execution line-by-line.
Step Out Shift+F11	When inside a method or subroutine, return to the earlier execution context by completing remaining lines of the current method as though it were a single command.
Restart Ctrl+Shift+F5	Terminate the current program execution and start debugging again using the current run configuration.
Stop Shift+F5	Terminate the current program execution.

Debug a File

Debug a File:

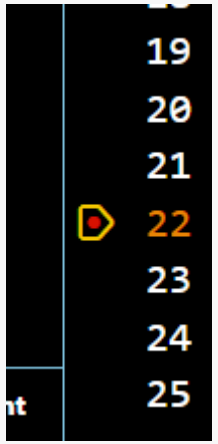
Insert breakpoints by selecting a line to place a “red dot”

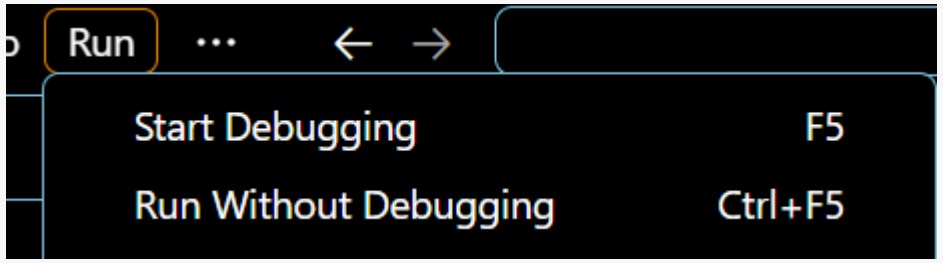
Run > Start Debugging

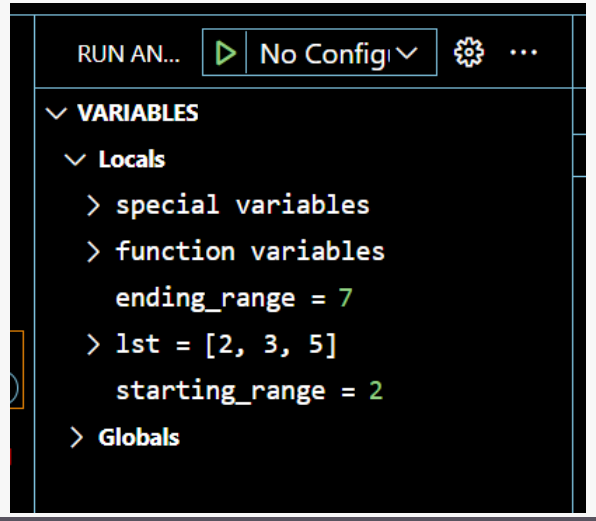
Opens a terminal automatically

Variables visible on the left side

Walk through the debug tools





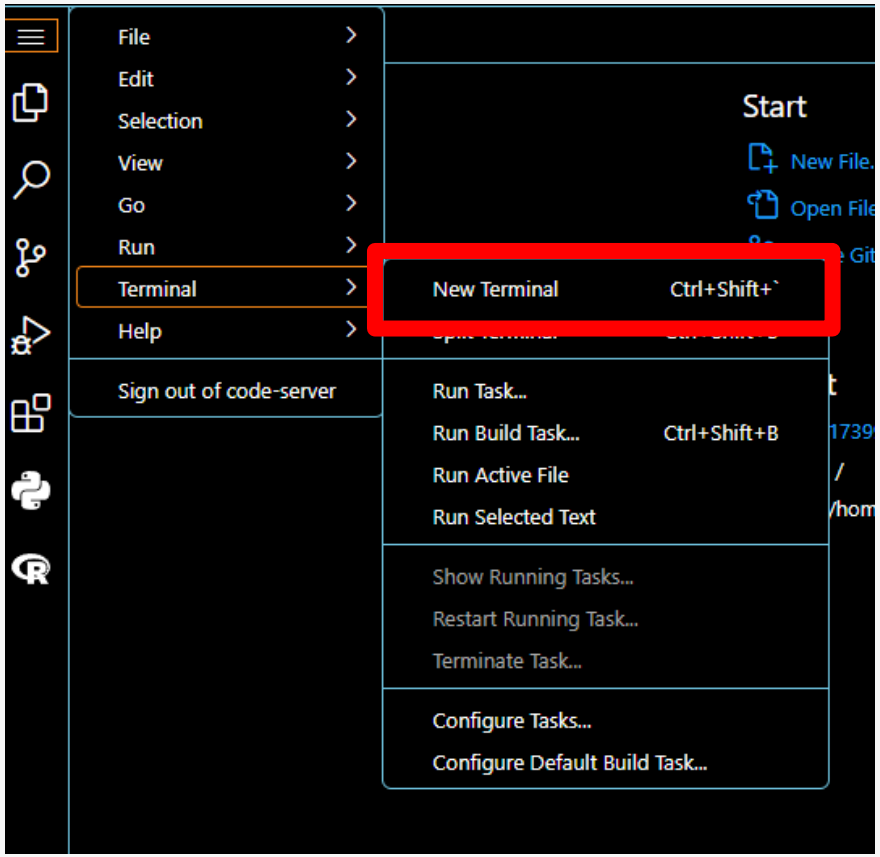


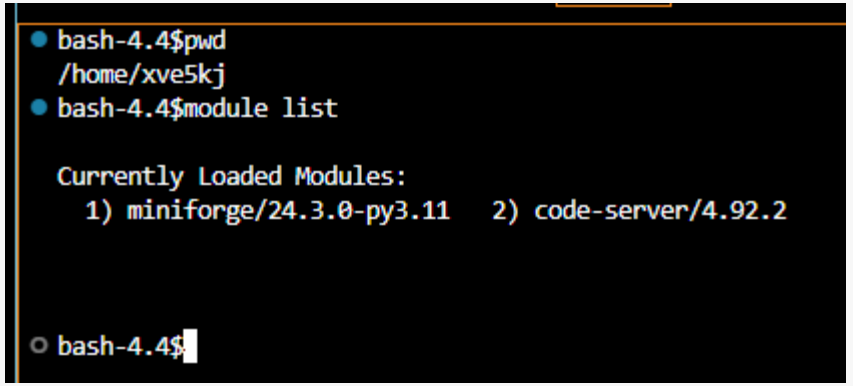
Open a Terminal

Open a Terminal:

Terminal > New Terminal

From here you can use regular terminal commands like "pwd" or even load modules!





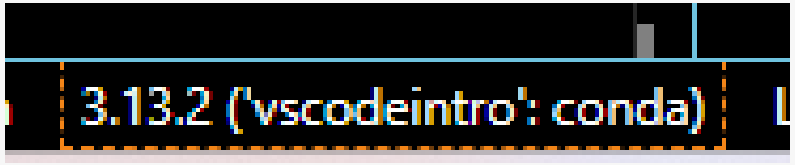
Create a Conda Env

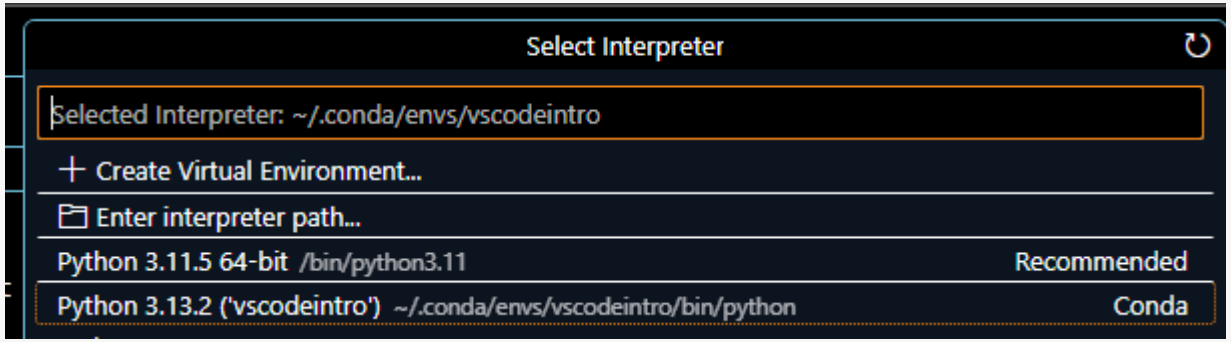
- In a new terminal:
  - conda create -n my_env python=3.11 numpy pandas
  - conda activate my_env
  - pip install matplotlib

Set Your Interpreter

Set Your Interpreter:

Select your environment from your list!





When you run your code it will run in your environment.

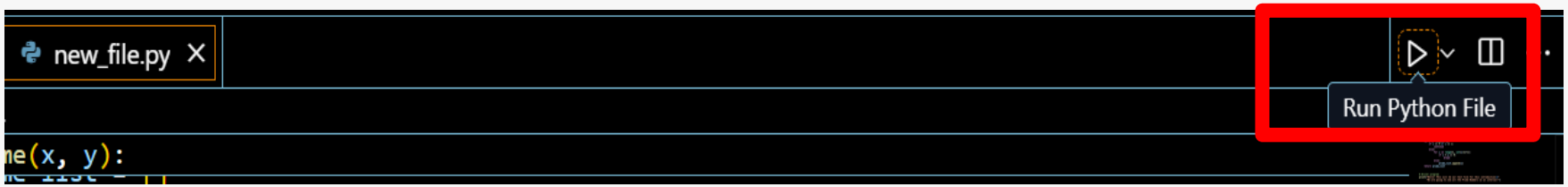
Run a File

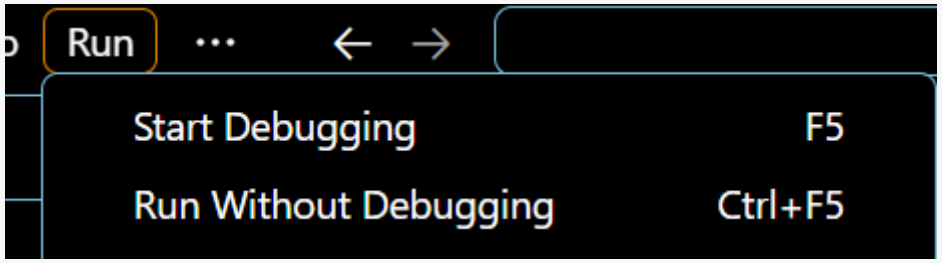
Run a File:

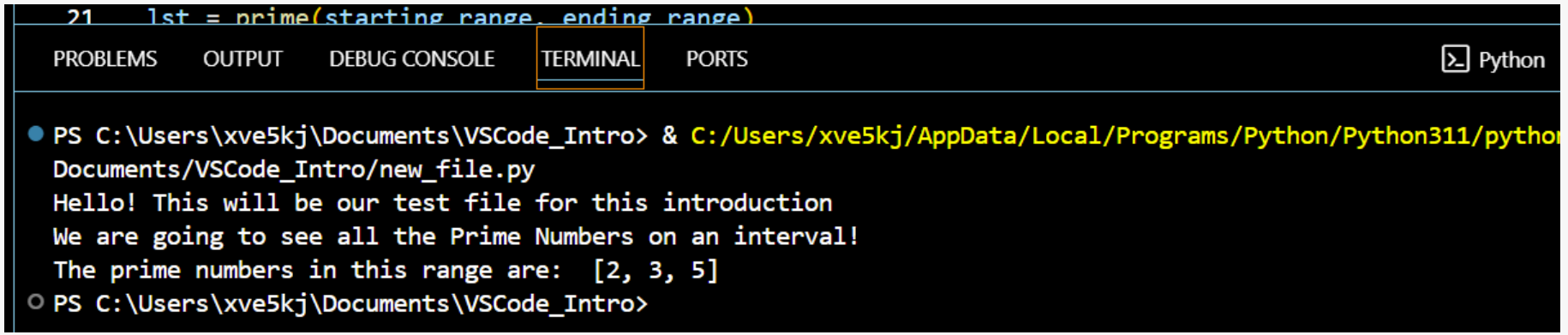
Modify your file with some basic runnable python code

Run > Run Without Debugging

Opens a terminal automatically





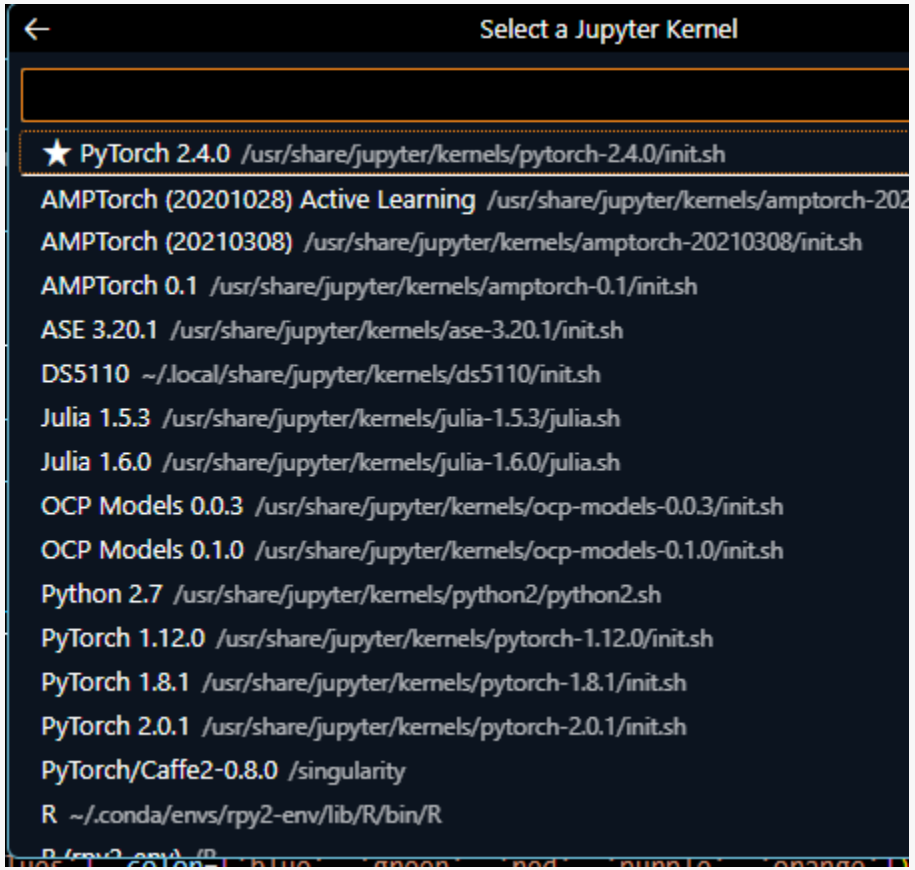


Jupyter Notebooks

Jupyter Notebooks:

Select kernel from the list of available kernels- or make your own!

Recently used kernels are "starred"



Create your own kernel from a conda environment:

https://www.rc.virginia.edu/userinfo/howtos/rivanna/custom-jupyter-kernels/

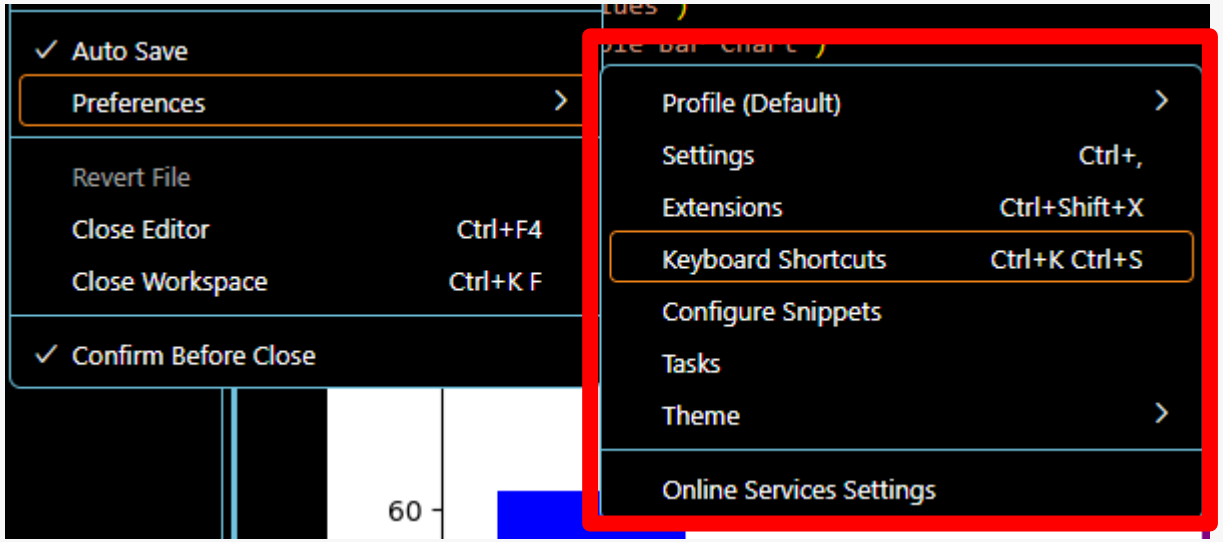
Customization

Customization:

File > Preferences

These changes stay even when you open a new interactive session

You can even download extra extensions!



LOCAL VS CODE WITH HPC

SSH

- UVA Network (VPN or On Grounds)
- Strong internet connection
- Connects you to the remote host, but keeps your local preferences

Download SSH Extension

Download SSH Extension:

"Remote – SSH" in the Marketplace

It is not **necessary** but it is a tool to make it **much** easier

Create Connection

Create Connection:

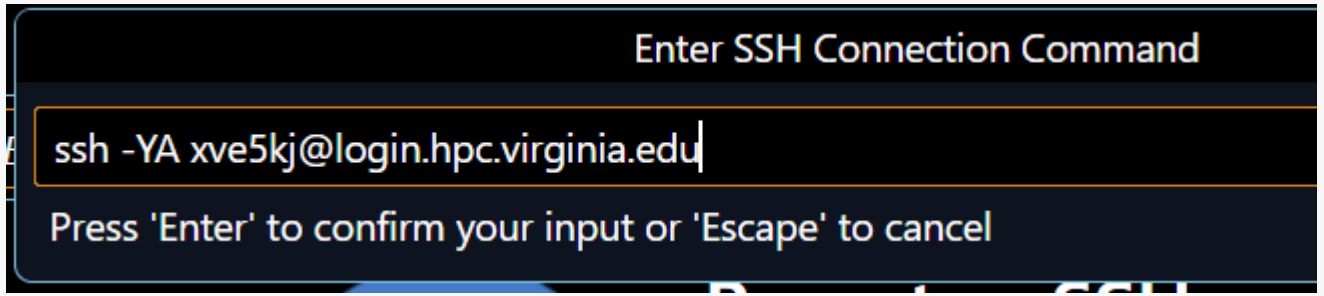
Connect to Host

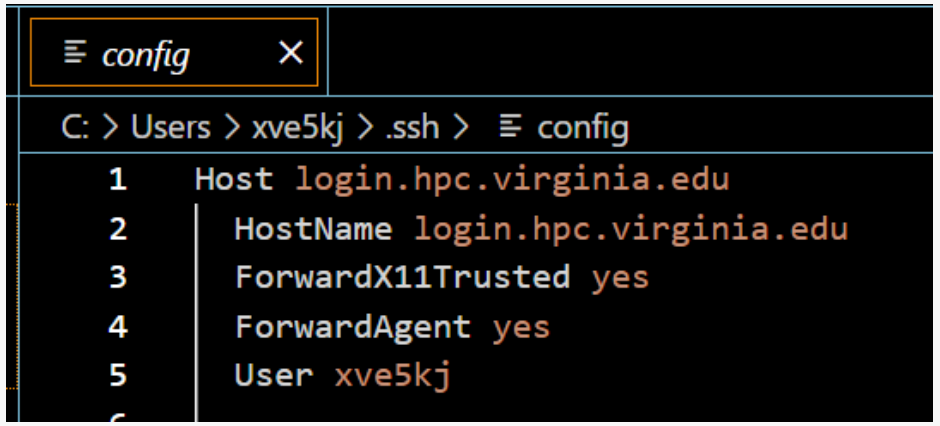
Add New SSH Host...

ssh –YA mst3k@login.hpc.virginia.edu

Modify your config file

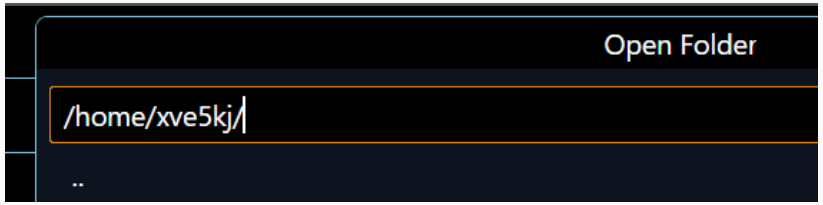
You can later open and edit the config file as you need

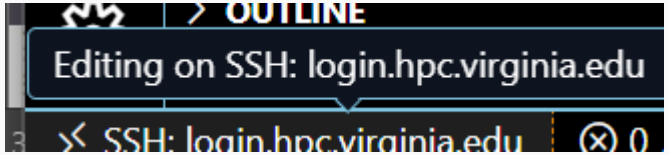




You Are Now Connected!

- Now that you are connected you can open up your workspaces you've created, open your folders, etc.
- You can see your connection in the bottom right
- You still stay connected so long as you stay on the network





Run an IJob

Run an IJob:

Open a new terminal

```
bash-4.4$ijob -c 6 -A hpc_training -p interactive --time=00:30:00
salloc: Pending job allocation 2523247
salloc: job 2523247 queued and waiting for resources
```

ijob -c 6 -A hpc_training -p interactive --time=00:30:00

Starts an ijob on the interactive partition with 6 cores for 30 minutes

Will need to wait for resources to be available

An ijob is **specific to the terminal you start it in**, you only have access to those resources in that terminal

The job ends if you close the terminal

Run an IJob

Important Caveats:

This is for running code via terminal commands

If you want to run python code you need to “Run Python File” first, then type in ijob command in that **new** terminal

Different method for JupyterLab

DO NOT RUN JOBS FROM IJOBS

Interactive JupyterLab

Interactive JupyterLab:

Start an ijob

module load miniforge jupyterlab

jupyter-notebook --no-browser --ip=0.0.0.0

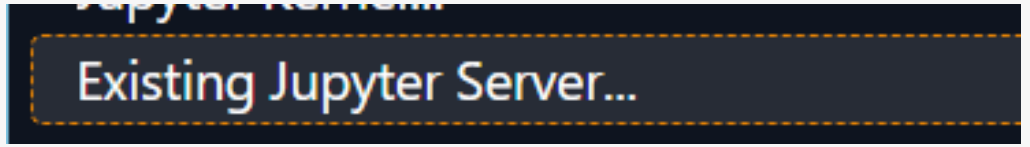
Copy the url that starts with http://

Select your kernel

Existing Jupyter Server

Paste Url > Enter

Select your kernel from the kernels we offer or your own!



Create your own kernel from a conda environment:

https://www.rc.virginia.edu/userinfo/howtos/rivanna/custom-jupyter-kernels/

ADVANCED FEATURES

Creating an SSH Key

Creating an SSH Key:

```
C:\Users\xve5kj>ssh-keygen
Generating public/private ed25519 key pair.
Enter file in which to save the key (C:\Users\xve5kj/.ssh/id_ed25519):
```

New bash terminal (local)

ssh-keygen

Navigate to your .ssh directory

cat your .pub file and copy it

Log in to remote server and paste your key in your /home/id/.ssh/authorized_keys file. If it does not exist, create it.

Passwordless login!

Source Control with Github

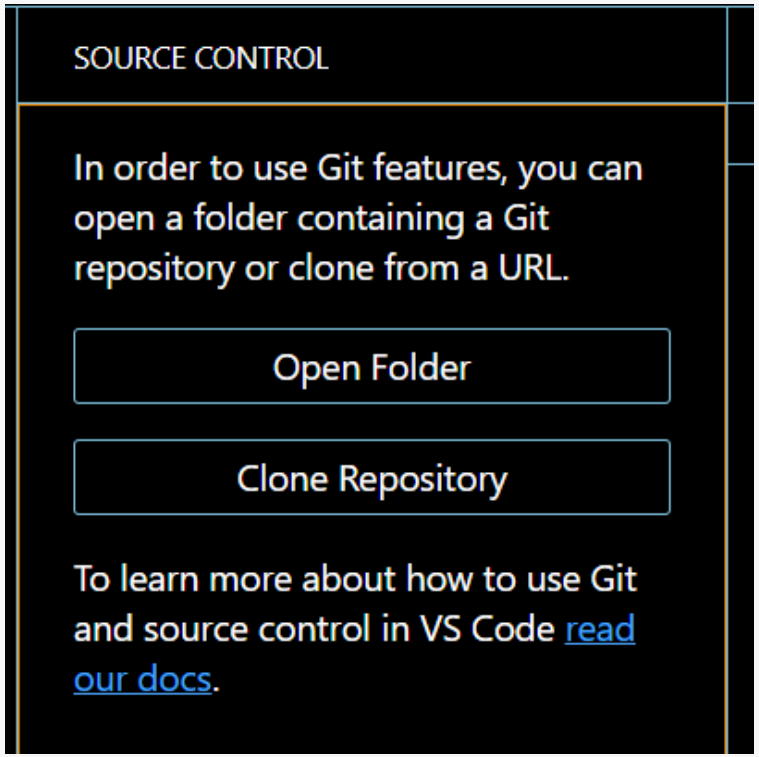
Source Control with Github:

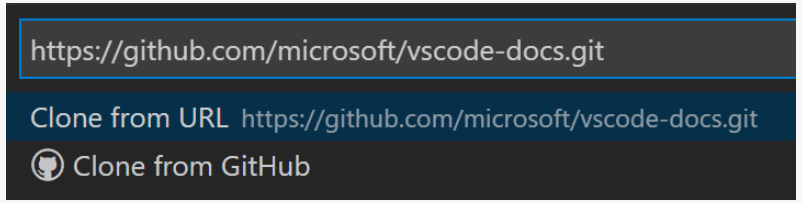
Open a Folder or Clone a Repository

Push/Pull/Commit

Create new branches

Even works on HPC without needing to load git module





Get started with Git and GitHub:

https://docs.github.com/en/get-started/start-your-journey/hello-world

NEED HELP?

xve5kj@virginia.edu ** hpc-support@virginia.edu

Zoom Office Hours:

Tuesdays 3pm-5pm ** Thursdays 10am-12pm

https://www.rc.virginia.edu/support/

THANK YOU

Hana Parece

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