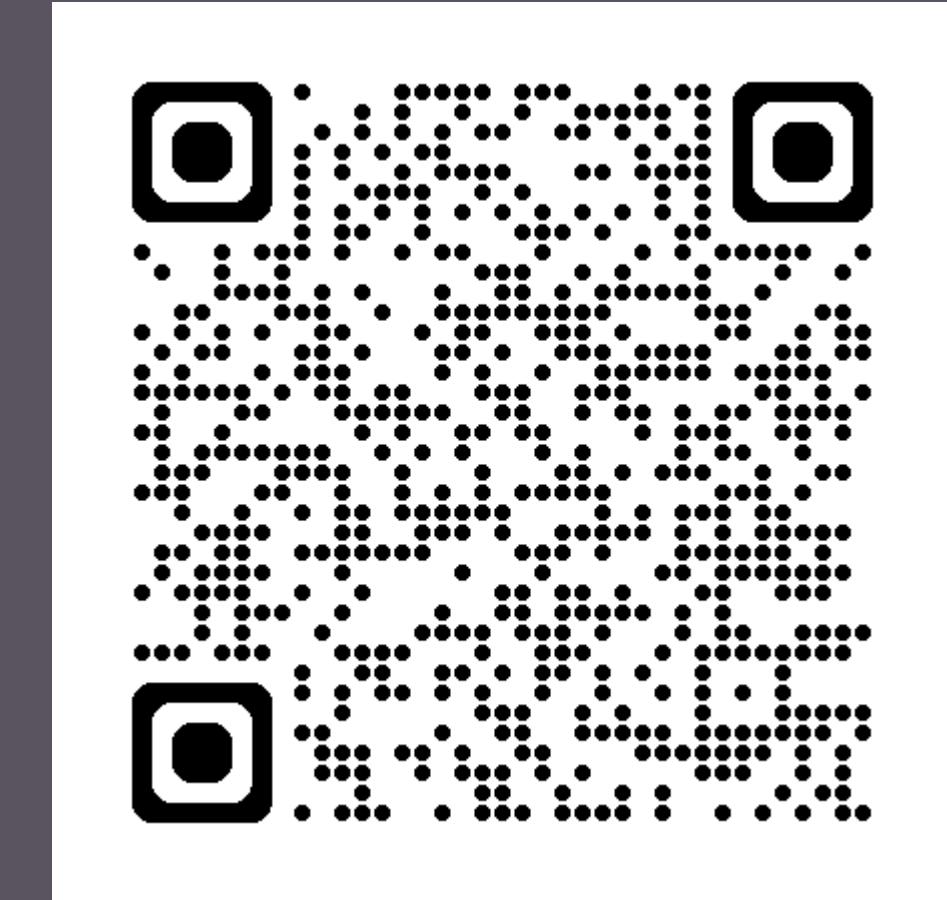


INTRODUCTION TO VISUAL STUDIO CODE FOR HPC

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?”

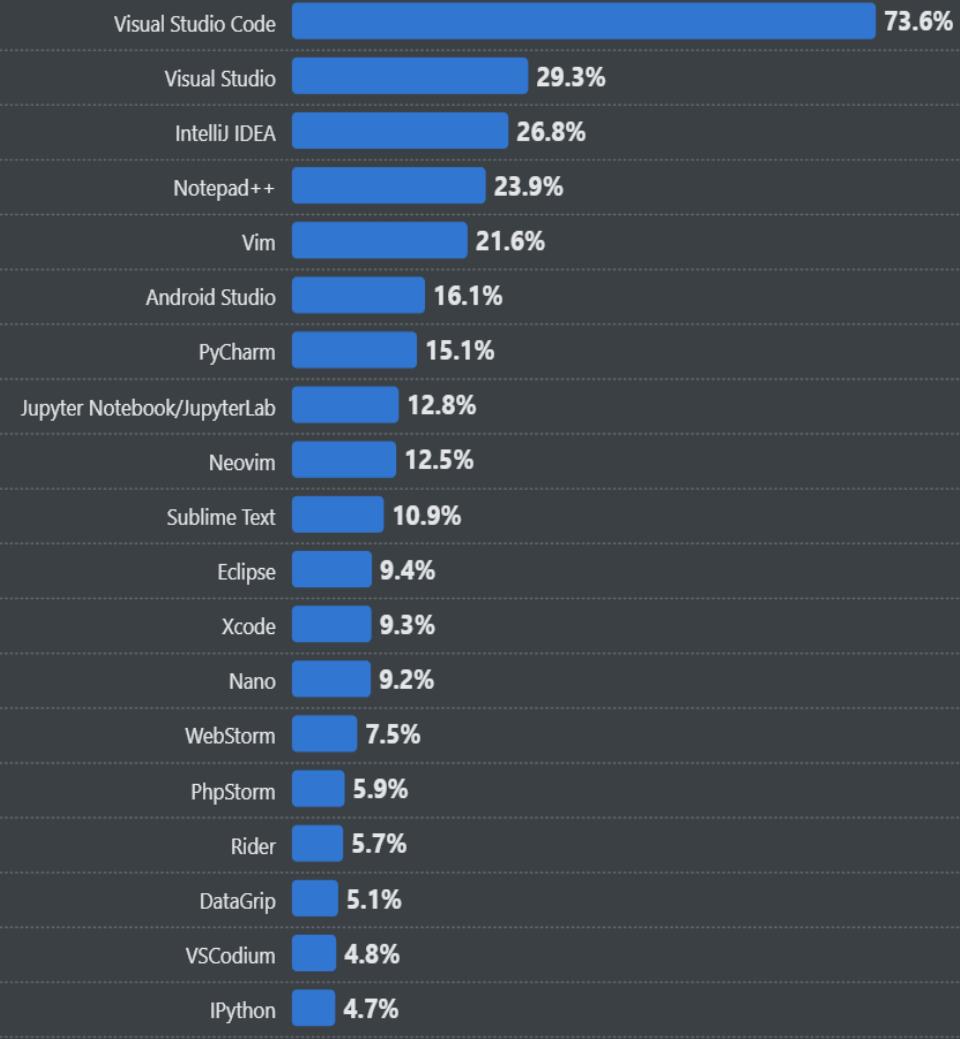


Background

- 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

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

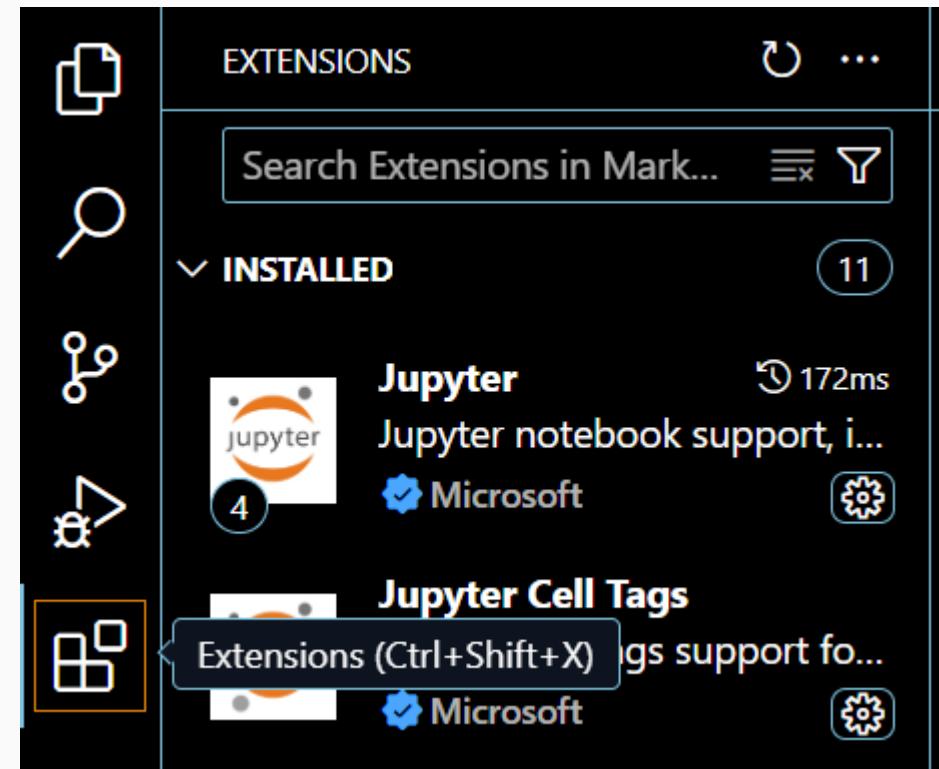


Useful Features

- 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/VSCodium>
- Extensions may require **software** to already be installed on your computer
 - Python, Java, etc.



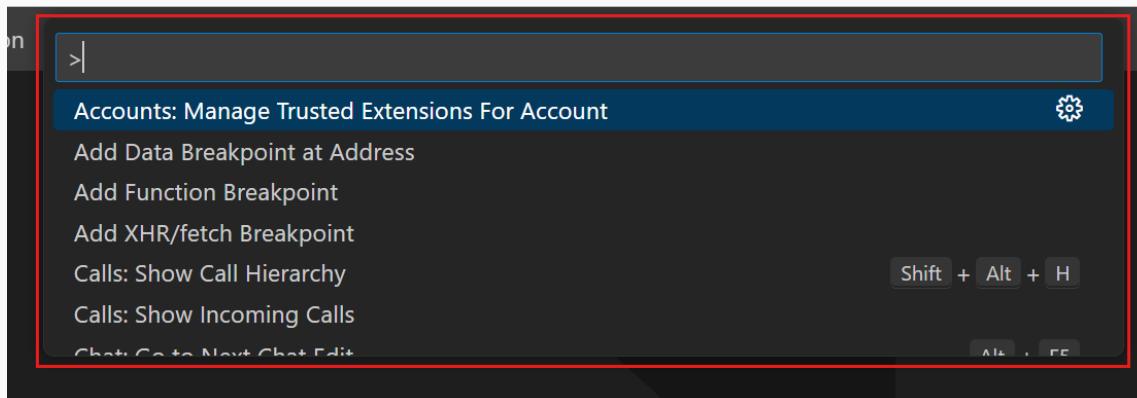
Useful Shortcuts

- **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 VS CODE 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>

Code Server

This app will launch a [VS Code server](#) using [Code Server](#) on the Rivanna/Afton Cluster. Python users please see [instructions](#).

Rivanna/Afton Partition

Interactive

- **Interactive** - (1-24 core) Rivanna/Afton node in the interactive partition.
- **Standard** - (1-40 cores) Rivanna/Afton node in the standard partition.
- **GPU** - (1-40 cores) Afton node that has NVIDIA GPU.
- **Bii,Bii-gpu** - (1-40 cores) Partition for Biocomplexity Institute and Initiative.
- [Learn More](#) - Rivanna Queueing Policies

Number of hours

5

Number of cores

3

Memory Request in GB (maximum 768G)

6

Allocation

hpc_build

VS Code Server

Code Server

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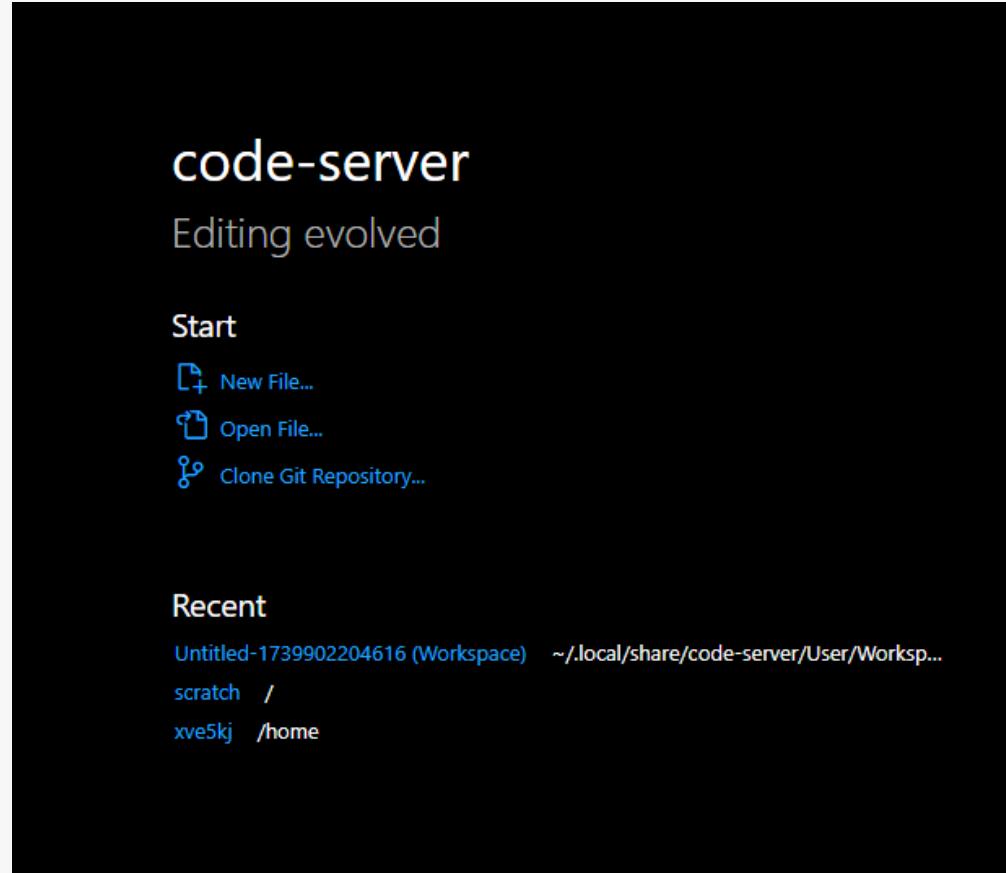
Allocation

hpc_build

- 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.

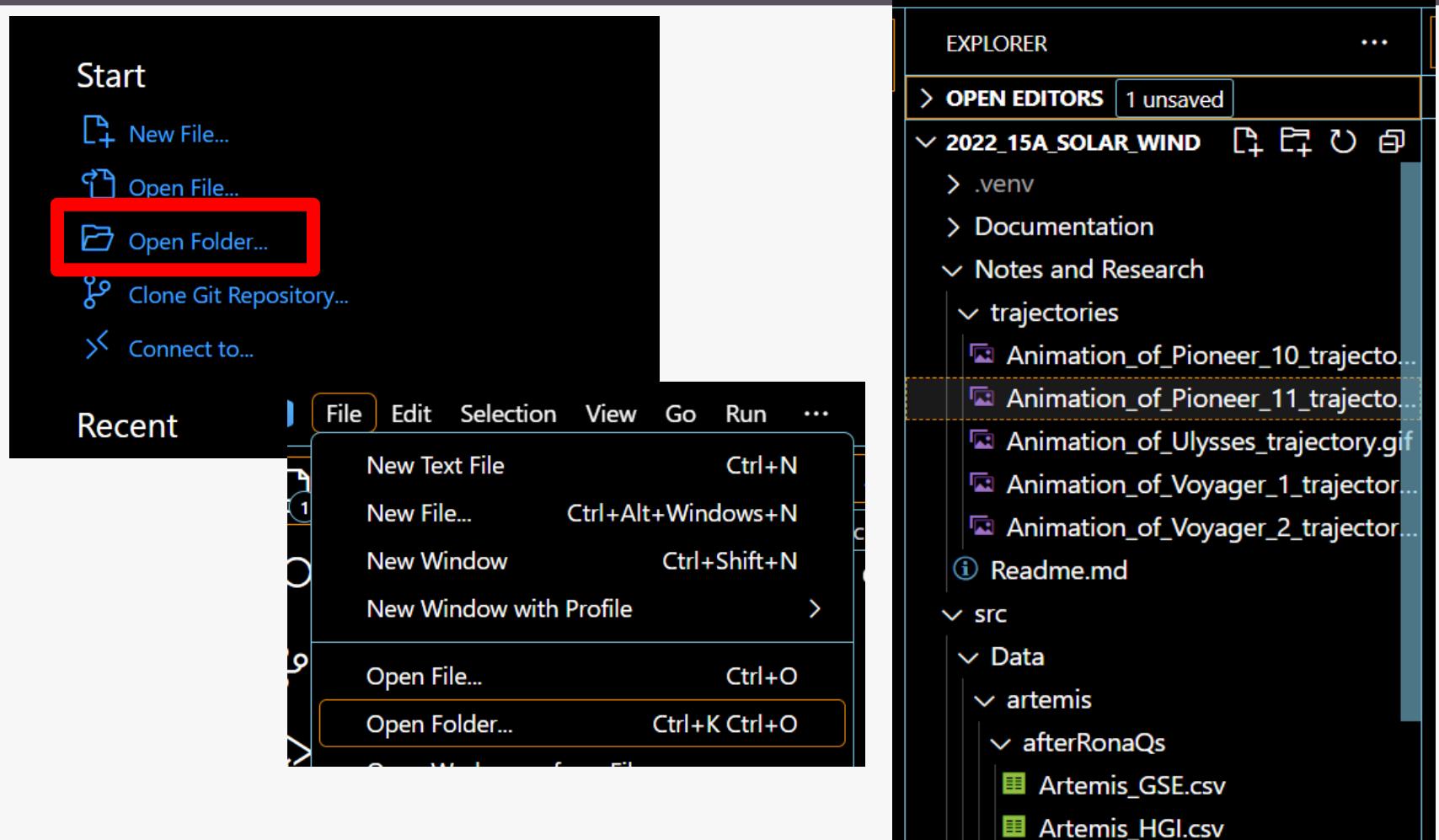


Open a Folder

Open a Folder:

Select File > Open
Folder...

Appears in the
explorer for easy
navigation

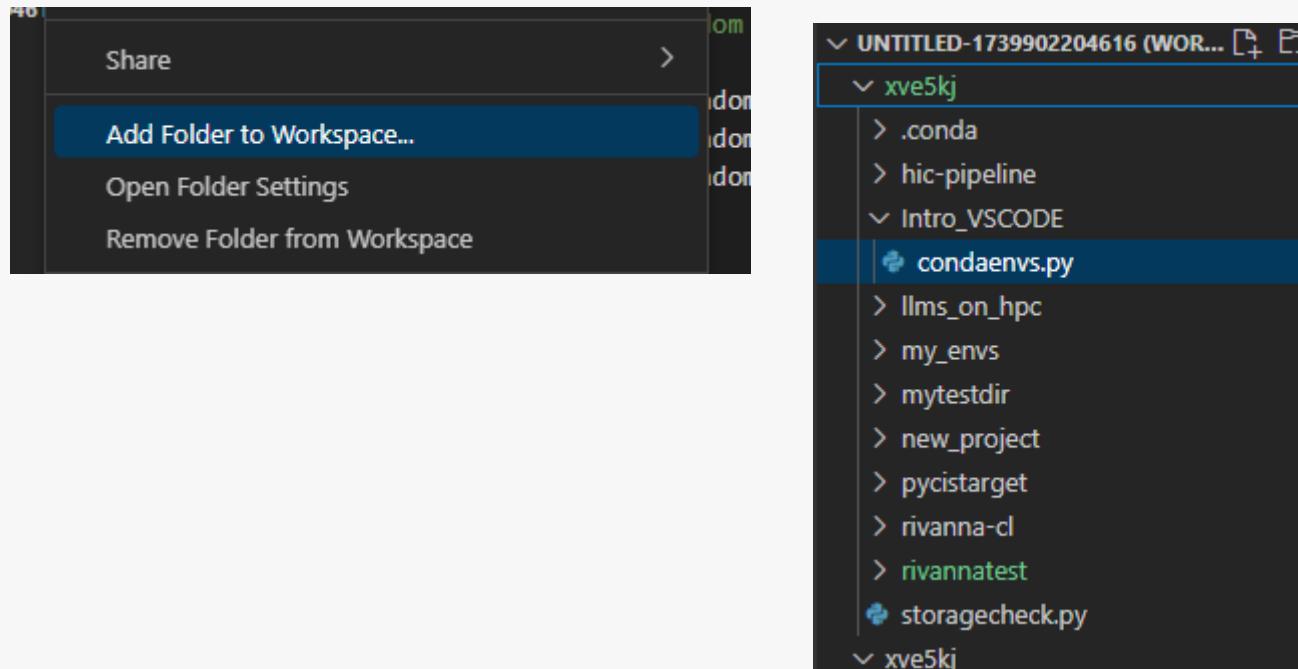


Add a Folder

Add a Folder:

Select File > Add a Folder to Workspace...

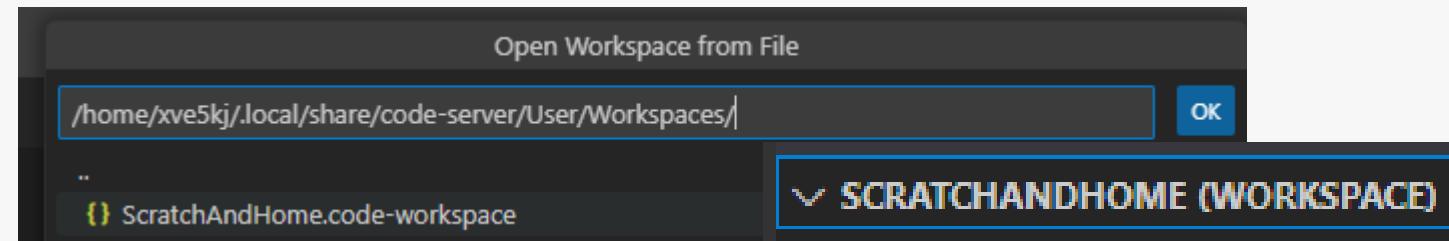
Appears in the explorer for easy navigation



Workspaces

Save a Workspace:

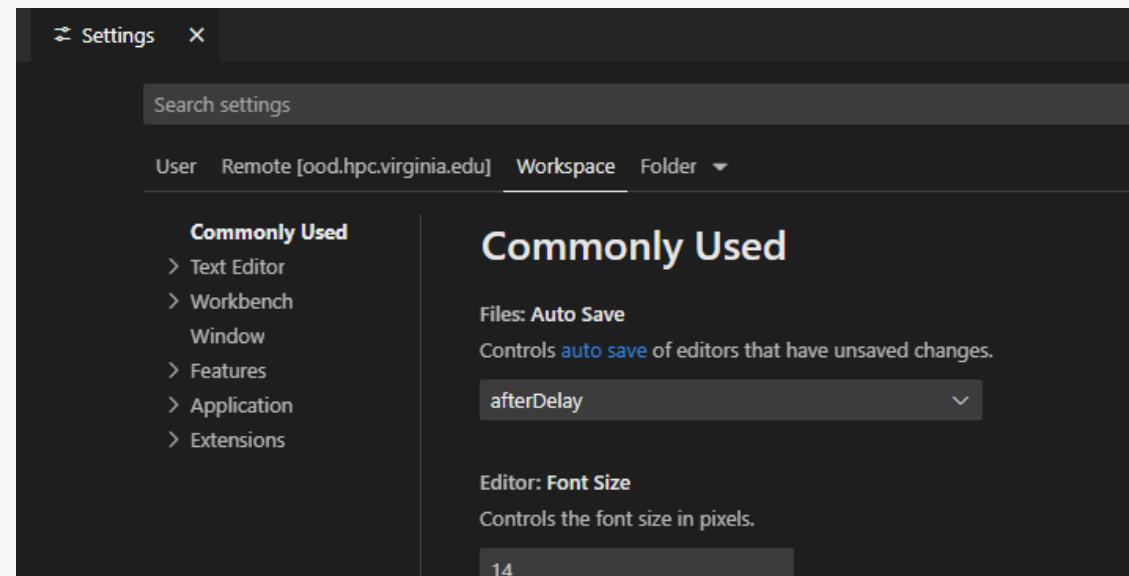
Select File > Save
Workspace As



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

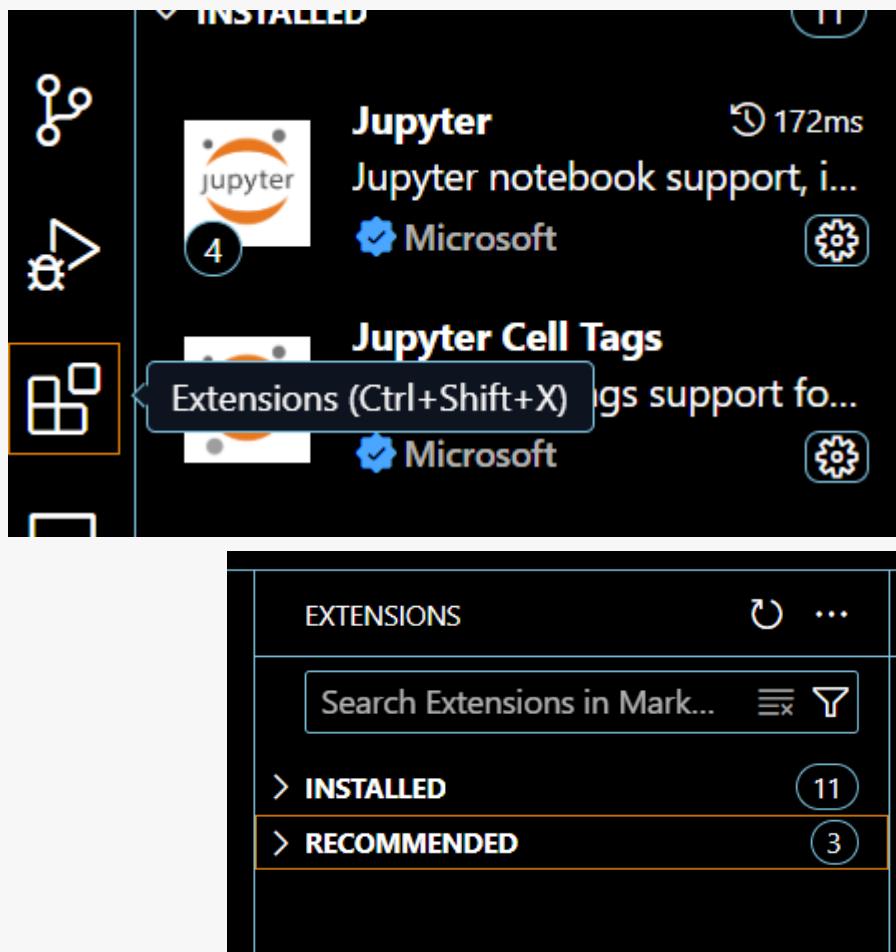
Install
Extensions:

Access the
marketplace in
your web browser

Or the extensions
tab in VS Code

(**crtl + shift + x**)

Install Python and
Jupyter



Python

Microsoft [microsoft.com](#) | 155,570,584 | ★★★★☆(4)

Python extension for Visual Studio Code

A Visual Studio Code extension with rich support for the Python language (for all actively supported Python versions), providing access points for extensions to seamlessly integrate and offer support for IntelliSense (Pylance), debugging (Python Debugger), formatting, linting, code navigation, refactoring, variable explorer, test explorer, and more!

Support for [vscode.dev](#)

The Python extension does offer some support when running on [vscode.dev](#) (which includes [github.dev](#)). This includes partial IntelliSense for open files in the editor.

Installed extensions

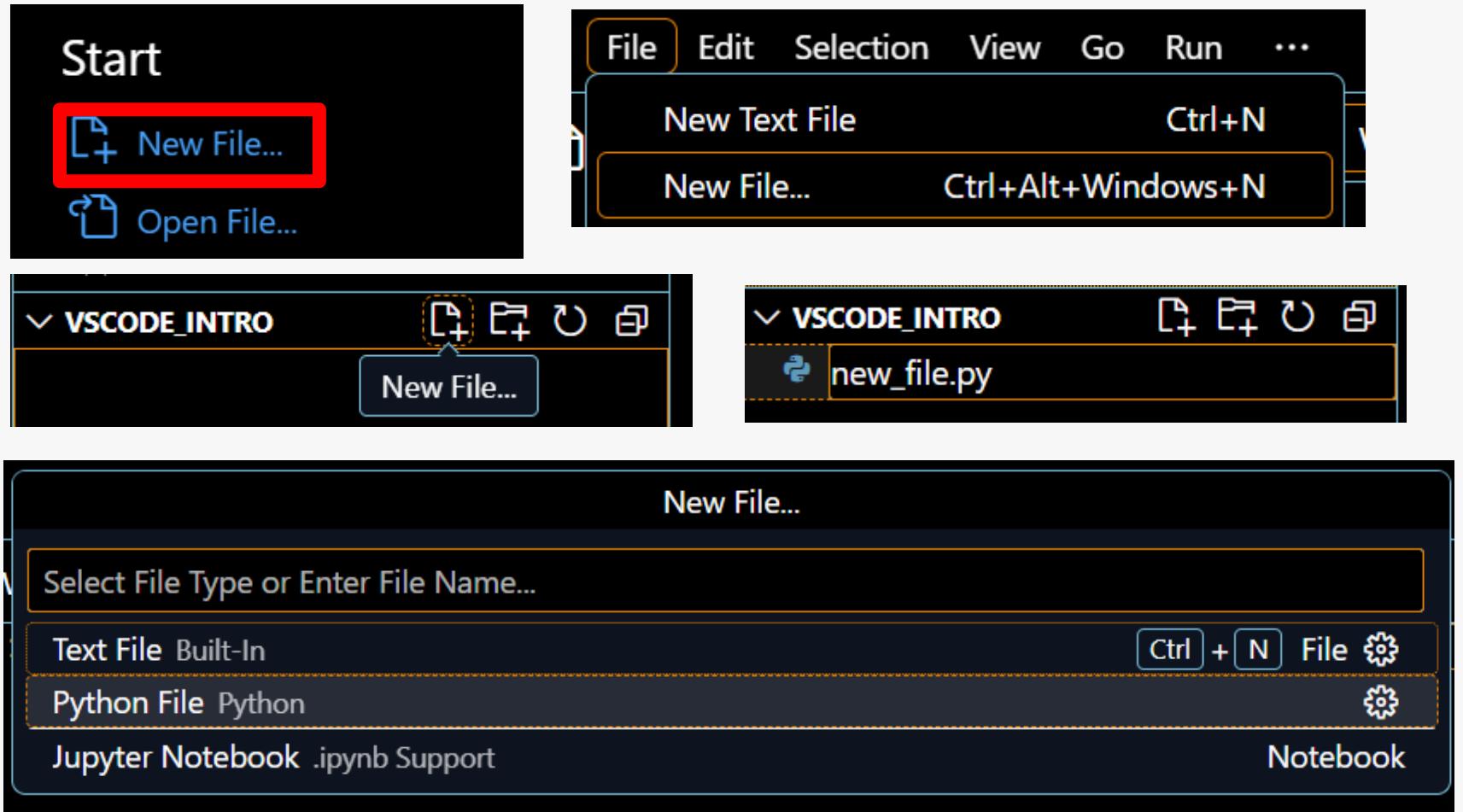
Creating a New File

Create a File:

File > New File...

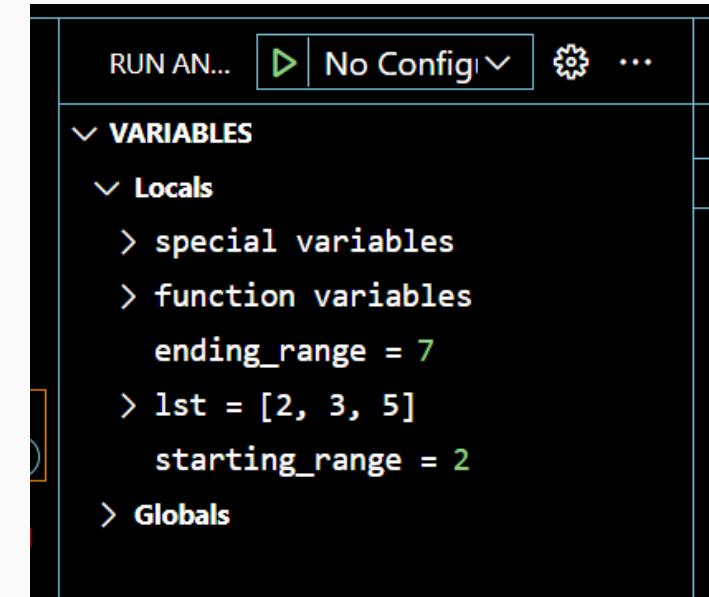
Select your file type

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 being 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:

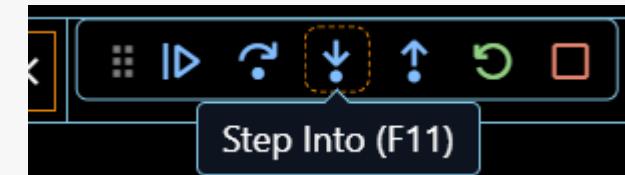
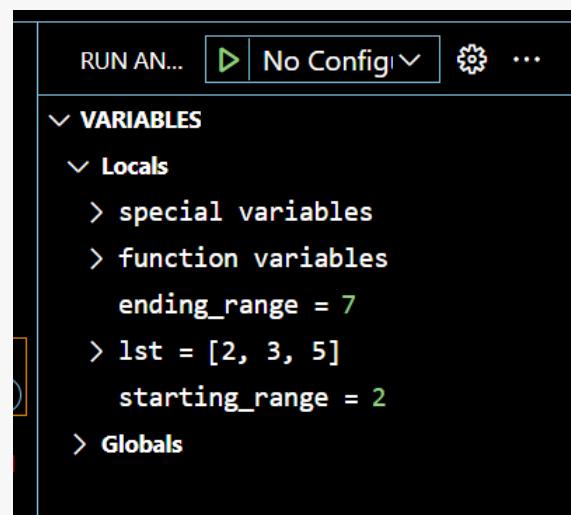
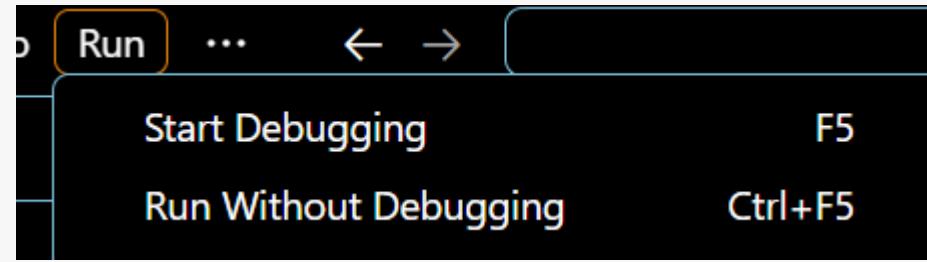
Insert breakpoints
by selecting a line
to place a “red dot”

Run > Start
Debugging

Opens a terminal
automatically

Variables visible on
the left side

Walk through the
debug tools

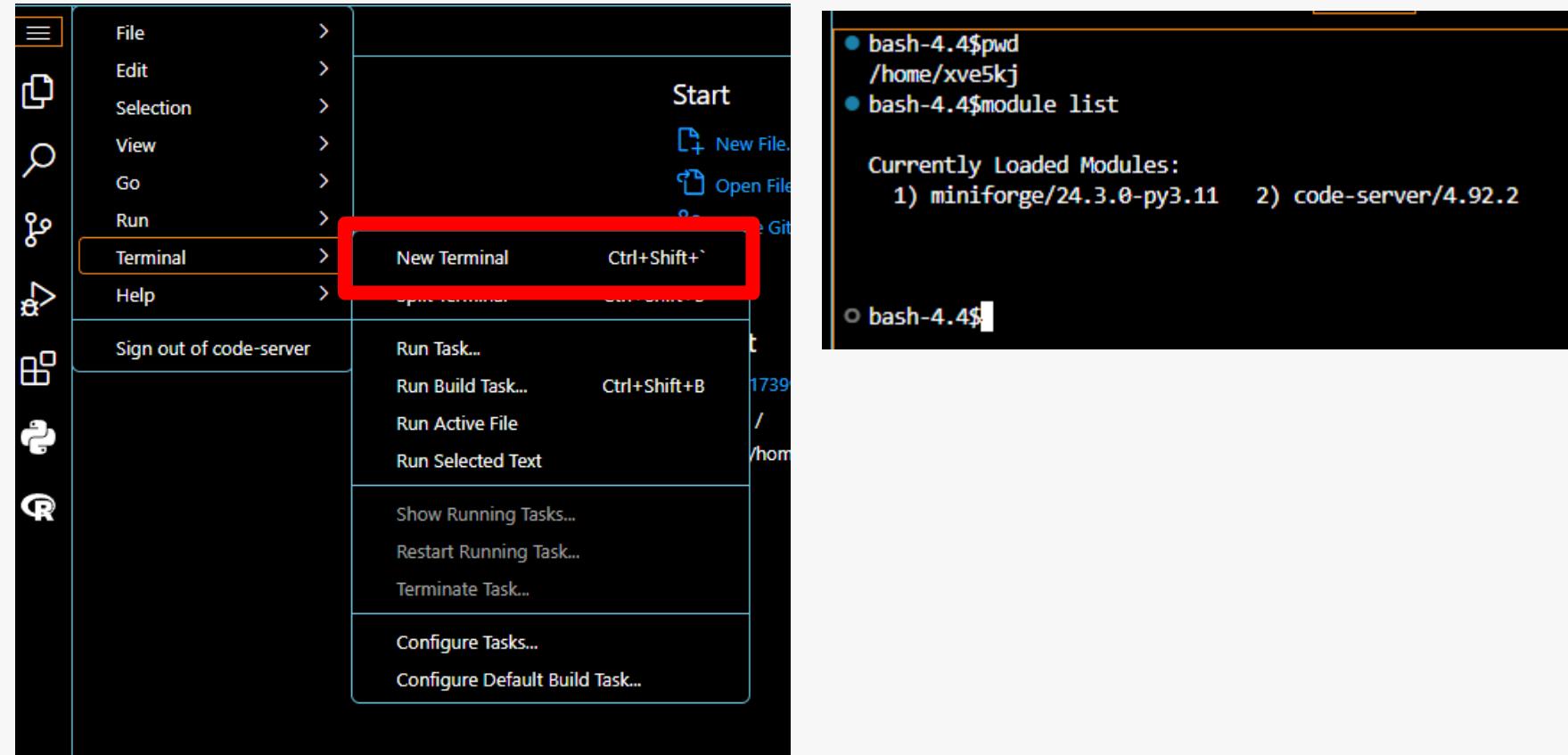


Open a Terminal

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.



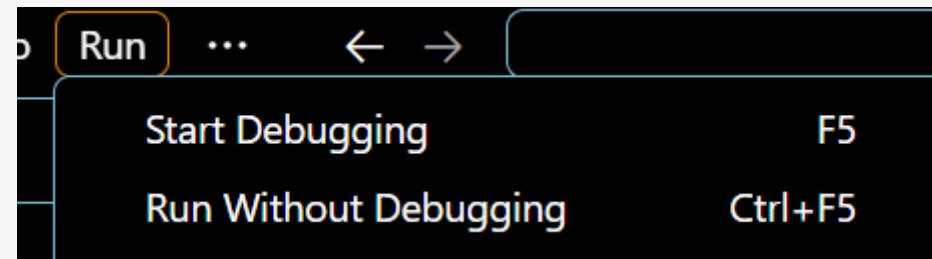
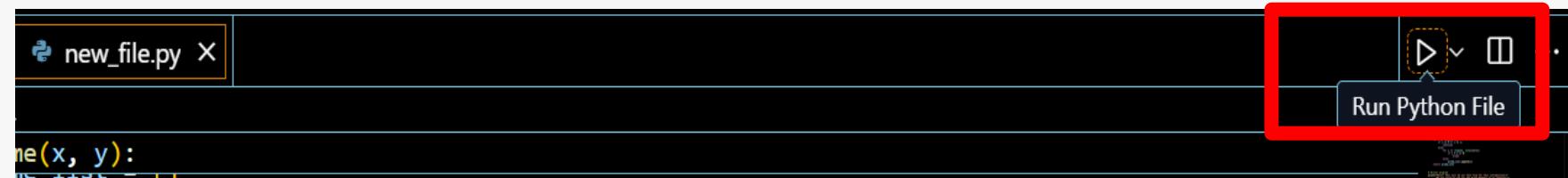
Run a File

Run a File:

Modify your file with some basic runnable python code

Run > Run Without Debugging

Opens a terminal automatically

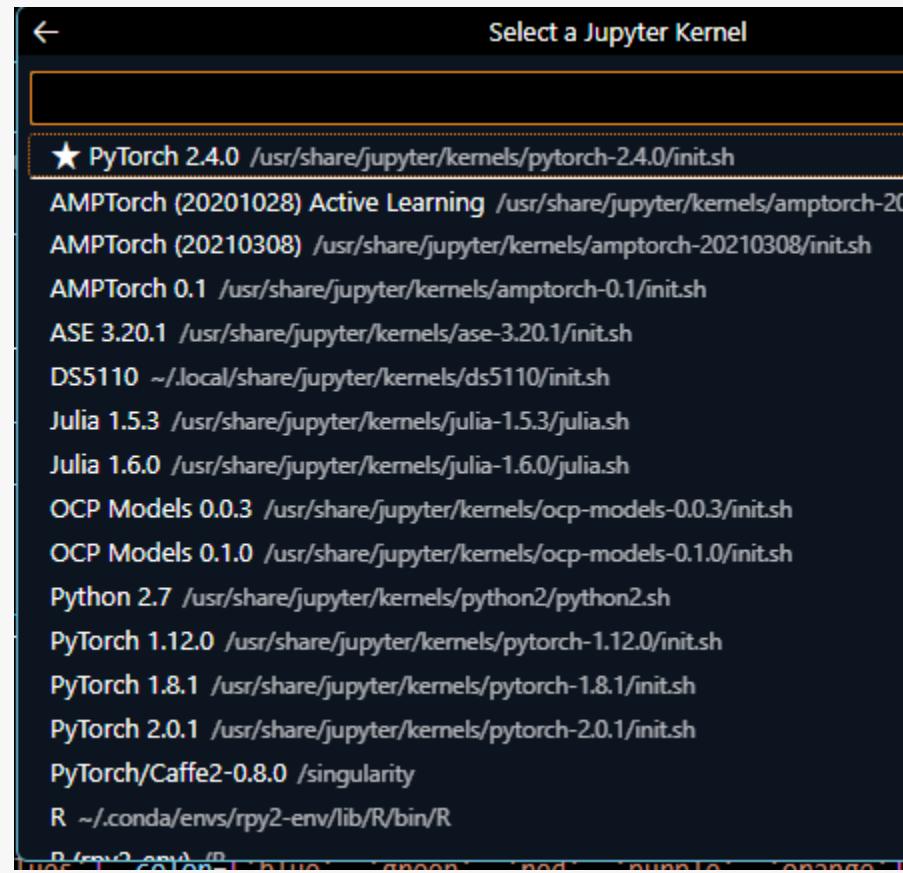
A screenshot of the VS Code terminal window. The terminal tab is active, showing the command "PS C:\Users\xve5kj\Documents\VSCode_Intro> & C:/Users/xve5kj/AppData/Local/Programs/Python/Python311/python Documents/VSCode_Intro/new_file.py". The output of the script is displayed below: "Hello! This will be our test file for this introduction", "We are going to see all the Prime Numbers on an interval!", "The prime numbers in this range are: [2, 3, 5]", and "PS C:\Users\xve5kj\Documents\VSCode_Intro>". The terminal tab is highlighted with a yellow box.

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/>

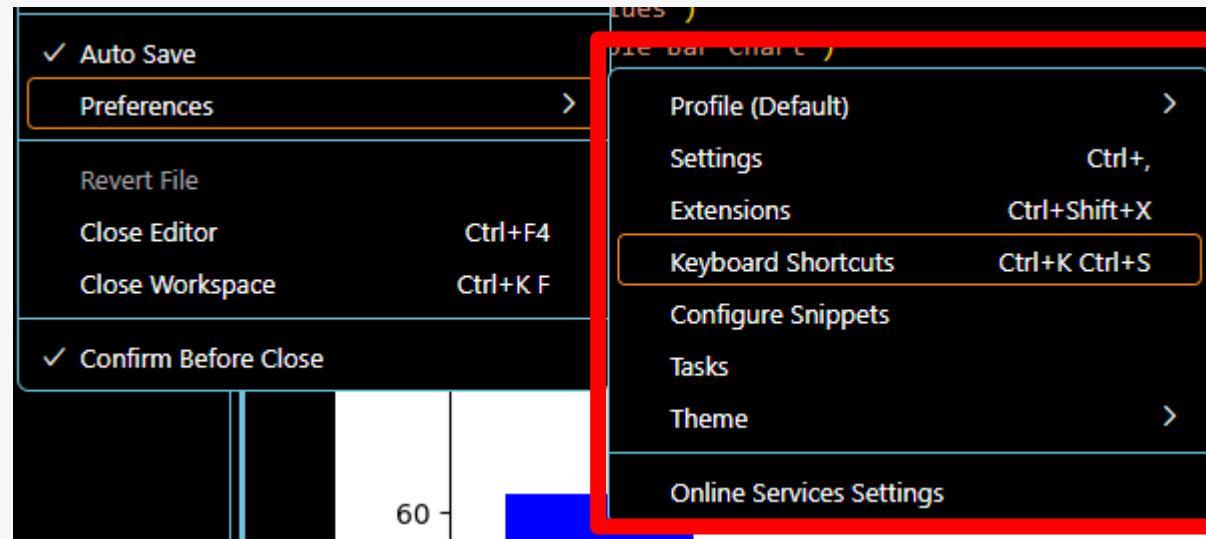
Customization

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

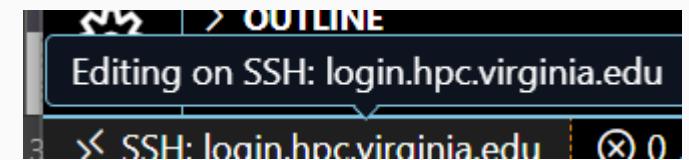
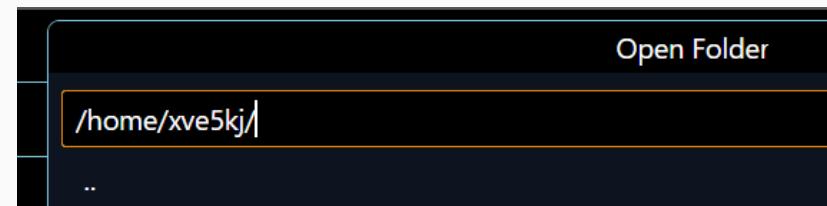
The screenshot shows a terminal interface with three main sections:

- Top Bar:** Shows a red box highlighting a small icon in the top-left corner. To its right are icons for a crossed-out host (error), a host with a question mark (warning), and a host with a warning sign (warning). On the far right is a button labeled "+ Add New SSH Host...".
- Middle Panel:** A large text input field contains the command: `ssh -YA xve5kj@login.hpc.virginia.edu`. Above the input field is the placeholder text "Enter SSH Connection Command". Below the input field is a message: "Press 'Enter' to confirm your input or 'Escape' to cancel".
- Bottom Panel:** A code editor window titled "config" shows the contents of a .ssh/config file. The file path is listed as "C: > Users > xve5kj > .ssh > config". The file contains the following configuration options:

```
Host login.hpc.virginia.edu
  HostName login.hpc.virginia.edu
  ForwardX11Trusted yes
  ForwardAgent yes
  User xve5kj
```

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
```

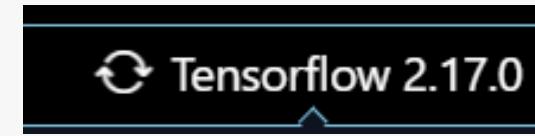
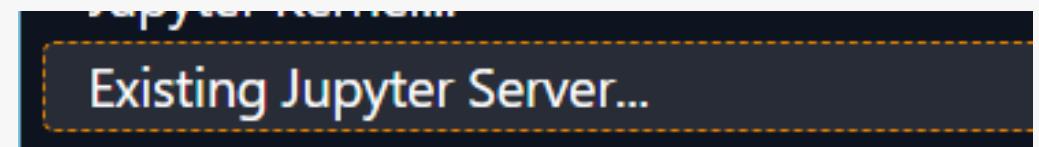
Copy the url that starts with http://

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/c
ustom-jupyter-kernels/](https://www.rc.virginia.edu/userinfo/howtos/rivanna/custom-jupyter-kernels/)

ADVANCED FEATURES

Creating an SSH Key

Creating an SSH Key:

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!

```
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):
```

Source Control with Github

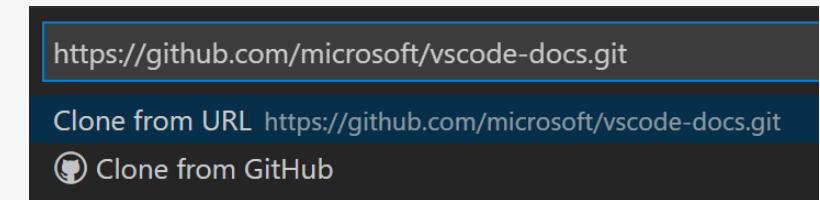
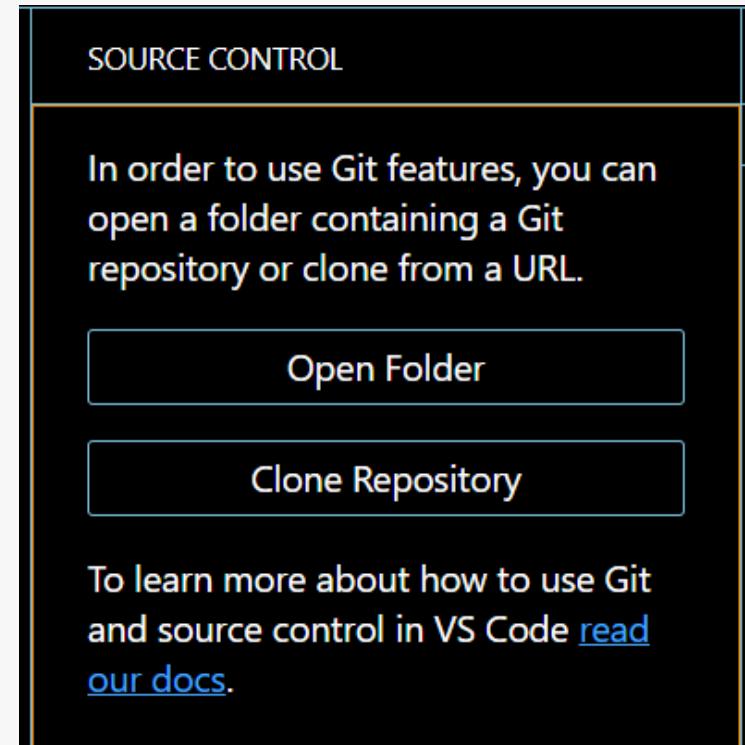
Source Control with Github:

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

xve5kj@virginia.edu

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