Space Telescope Environment (`stenv`)

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Space Telescope Science Institute

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CONTENTS

1 Getting Started 3

2 Frequently Asked Questions 7

3 Developer Notes 9

4 Pipeline Releases 13

5 Windows Support 17

`stenv` is an installable Conda environment maintained by the Space Telescope Science Institute (STScI) in Baltimore, Maryland. This environment provides tools and utilities required to process and analyze data from the Hubble Space Telescope (HST), James Webb Space Telescope (JWST), and others.

CHAPTER

ONE

GETTING STARTED

1.1 Conda Basics

`stenv` defines a Conda environment, which is a set of packages installed together at specific versions. A Conda environment is designed to be isolated from system packages, and can be **activated** to switch the current context (PATH, environment variables, available binaries, Python installation, etc.) to an isolated instance that is separate from the system. (This is similar to using `source bin/activate`, if you are familiar with Python virtualenvs). This has the advantage of allowing several separate installations of Python packages and other tools without cluttering the system installation, allowing switching between use cases or package contexts at will.

1.2 Installation

1.2.1 Install Conda

A Conda distribution provides the `conda` command, which lets you create, manage, and activate new environments. Try running the `conda` command in your terminal. If you get `conda: command not found` (or similar), you will need to install a conda distribution. If you already have a `conda` command in your terminal, you can skip to the next step.

The easiest option is to install Miniconda, which is full-featured but installs a minimal set of default packages initially. We will install more packages later on.

Alternatives include Miniforge, which includes the `mamba` command (a much faster drop-in replacement for `conda` with all the same functionality) and Anaconda which provides a full-featured base environment as well as hundreds of useful tools, libraries, and utilities by default.

Note: The below instructions will work for any of the distributions, though users with `mamba` installed will notice a speedup if they substitute `mamba` for `conda` where it appears in commands.

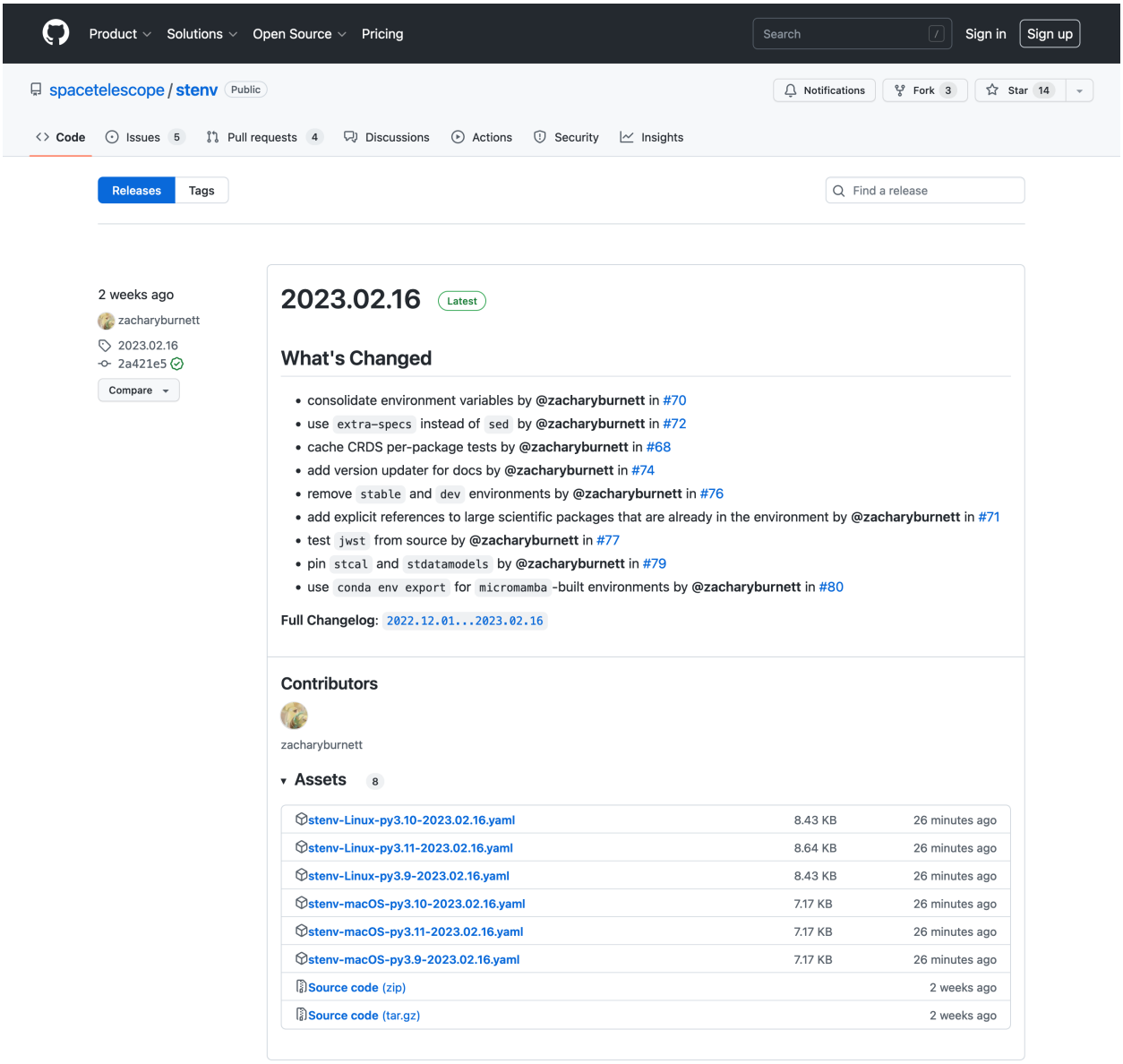
Important: Remember to run `conda init` when installing. This is required in order to set up your shell to `activate` and `deactivate` environments.

```
conda init
```

```
mamba init
```

1.2.2 Choose an `stenv` release

Now that you have a Conda installation, you should choose a release of `stenv` from the Releases page and choose the environment definition file from the `Assets` section that corresponds with your platform.



Every release is available for several combinations of operating system and Python version. The name of the release file indicates which is which. For example, a release of stenv for Python `3.11` on Linux will be named something like `stenv-Linux-X64-py3.11-YYYY.MM.DD.yaml` (where `YYYY.MM.DD` is the date of the release). Unless you have particular requirements, you should choose the newest (highest-numbered) Python version available.

Note: Version numbers aren't real numbers; a hypothetical Python `3.20` would be newer than Python `3.2`.

Warning: **Can't find the release you need?** Building and testing environments on supported platforms may take

several minutes; for new releases, you may need to wait for the associated workflow job to finish before environment files are available.

Note: Every Conda environment has a name, specified by the `--name` or `-n` option. If you include the version numbers in the name, it will be easier to keep track of which version of `stenv` you have. Therefore, I recommend using a more descriptive name than `stenv` for your environment; for example, use something like `stenv-py3.11-2023.01.01` (changed as needed to match the version you chose).

Right-click (or control-click on macOS) on the link to the release file and choose `Copy Link` (or `Copy Link Address`). Then, run the following command in a terminal, replacing `<URL>` with the URL you copied in the previous step:

```
conda env create --name stenv --file <URL>
```

```
mamba env create --name stenv --file <URL>
```

Download the release file you chose. Then, run the following command in a terminal, replacing `~/Downloads/stenv-pyXX-YY.MM.DD.yaml` with the path to the file you downloaded:

```
conda env create --name stenv --file ~/Downloads/stenv-pyXX-YY.MM.DD.yaml
```

```
mamba env create --name stenv --file ~/Downloads/stenv-pyXX-YY.MM.DD.yaml
```

Note: If the build does not succeed on your system, please refer to *stenv doesn't build on my system; what do I do?*

1.3 Activating an environment

Environments let you install packages while isolating them from the rest of your system, and even each other. Even though we just created an environment, we will not be able to import the new packages yet:

```
$ python -c 'import jwst; print("ok")'
Traceback (most recent call last):
  File "<string>", line 1, in <module>
ModuleNotFoundError: No module named 'jwst'
```

In order to access the packages in `stenv`, you must first `activate` the environment you just created:

Important: If you chose another name when creating the environment, use that here instead.

```
conda activate stenv
```

```
mamba activate stenv
```

Activating a Conda environment changes which Python interpreter and packages are in use for that session (i.e. terminal window). Now, if you try to `import jwst`:

```
(stenv) $ python -c 'import jwst; print("ok")'
```

Every time you open a new terminal window, you will need to activate the environment before you can use `stenv` software.

Note: You can show installed packages available within a Conda environment with `conda list`:

```
conda list
```

```
mamba list
```

To `deactivate` an environment and return your shell to normal, close your terminal window or run `conda deactivate`:

```
conda deactivate
```

```
mamba deactivate
```

1.4 Deleting an environment

To delete an environment with all of its packages, run `conda env remove --name <name>`:

Important: If you chose another name when creating the environment, use that here instead.

```
conda env remove --name stenv
```

```
mamba env remove --name stenv
```

CHAPTER

TWO

FREQUENTLY ASKED QUESTIONS

2.1 `stenv` doesn't build on my system; what do I do?

You can use the environment definition YAML file (*environment.yaml*) in the root of the repository:

```
conda env create -n stenv -f https://raw.githubusercontent.com/spacetelescope/stenv/main/
↪environment.yaml
```

```
mamba env create -n stenv -f https://raw.githubusercontent.com/spacetelescope/stenv/main/
↪environment.yaml
```

This environment is unpinned, meaning it may take some time to resolve dependency versions. Additionally, the resulting package versions may not have been tested for your platform.

Warning: `stenv` does not currently support a native Windows installation. To build `stenv` on Windows, see *Windows Support*.

2.2 Why isn't _____ package in `stenv`?

Not all STScI packages are included in the base `stenv` environment; some packages are not supported and / or deprecated, and some are deemed too niche (or dependent on too many extra packages) to be included for all users.

To install a package in your local environment, you can use `pip install` while the environment is activated:

```
conda activate stenv
pip install <package_name>
```

```
mamba activate stenv
pip install <package_name>
```

To request that a new package be added to `stenv` (*environment.yaml*) for all users, see *Adding a package to stenv*.

2.3 What about Astroconda?

Astroconda, historically maintained by STScI as a Conda software channel, provides data analysis tools and pipelines via the Conda package management system.

> **Warning:** Astroconda is no longer supported as of **February 1st, 2023**.

`stenv` supersedes Astroconda as a STScI software distribution; it supports most of the packages in Astroconda, works with all current versions of Python, and provides a common environment for both the Hubble Space Telescope (HST) and James Webb Space Telescope (JWST) pipelines. Additionally, while Astroconda primarily uses Conda recipes to build and serve packages, which need to be updated separately from PyPI releases, `stenv` draws most of its packages directly from PyPI with `pip` (though it still requires use of a Conda environment for `hstcal` and `fitsverify`, which are provided by `conda-forge`).

CHAPTER

THREE

DEVELOPER NOTES

`stenv` consists of several parts:

1. an unpinned Conda environment definition YAML file *environment.yaml*
2. a GitHub Actions CI workflow that automatically builds and tests the environment on several platforms
3. regular GitHub releases with attached constrained Conda environment definition YAML files for every tested platform

3.1 environment.yaml

```
# this is the base unpinned environment for ``stenv``; to manually resolve an environment␣
↪from this file, run the following:
# conda env create -n stenv -f https://raw.githubusercontent.com/spacetelescope/stenv/
↪main/environment.yaml

channels:
  - conda-forge

dependencies:
  - astropy
  - dask
  - fitsverify
  - hstcal
  - h5py
  - ipython
  - jupyter
  - numpy
  - pip
  - pytables
  - python<3.12
  - pytest
  - pytest-xdist
  - scipy
  - scikit-image
  - sphinx
  - pip:
      - acstools
      - asdf
      - calcos
```

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```
    - ccdproc
    - ci_watson
    - costools
    - crds
    - drizzlepac
    - ginga
    - jwst
    - nictools
    - pysynphot
    - reftools
    - stcal
    - stdatamodels
    - stistools
    - stsynphot
    - stregion
    - synphot
    - wfc3tools
    - wfpc2tools
```

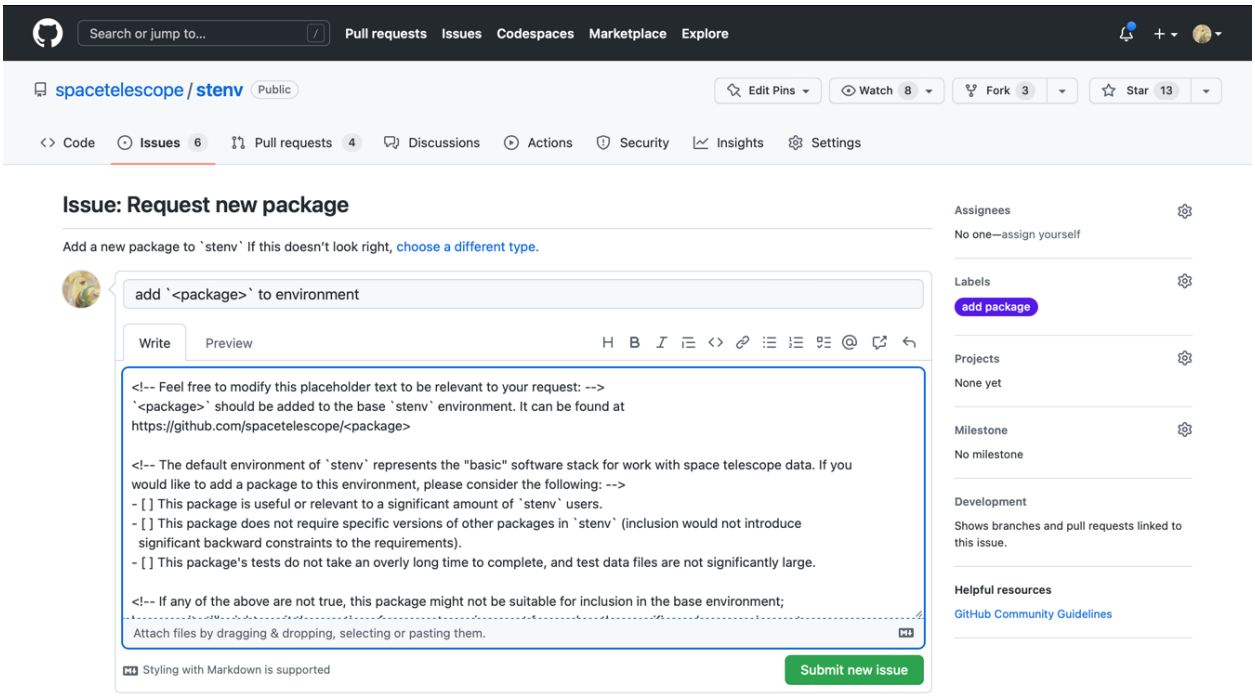
To build an environment from this unpinned environment definition, you may run the following:

```
conda env create -n stenv -f https://raw.githubusercontent.com/spacetelescope/stenv/main/
↪environment.yaml
```

```
mamba env create -n stenv -f https://raw.githubusercontent.com/spacetelescope/stenv/main/
↪environment.yaml
```

3.2 Adding a package to `stenv`

To request that a new package be added to `stenv`, please create a new issue in the repository.


Search or jump to...
Pull requests
Issues
Codespaces
Marketplace
Explore
spacetelescope / stenv
Public
Edit Pins
Watch 8
Fork 3
Star 13
Code
Issues 6
Pull requests 4
Discussions
Actions
Security
Insights
Settings
Issue: Request new package
Add a new package to `stenv` If this doesn't look right, choose a different type.
add `<package>` to environment
Write
Preview
<!-- Feel free to modify this placeholder text to be relevant to your request: -->
`<package>` should be added to the base `stenv` environment. It can be found at
https://github.com/spacetelescope/<package>
<!-- The default environment of `stenv` represents the "basic" software stack for work with space telescope data. If you would like to add a package to this environment, please consider the following: -->
- [ ] This package is useful or relevant to a significant amount of `stenv` users.
- [ ] This package does not require specific versions of other packages in `stenv` (inclusion would not introduce significant backward constraints to the requirements).
- [ ] This package's tests do not take an overly long time to complete, and test data files are not significantly large.
<!-- If any of the above are not true, this package might not be suitable for inclusion in the base environment;
Attach files by dragging & dropping, selecting or pasting them.
Styling with Markdown is supported
Submit new issue
Assignees
No one—assign yourself
Labels
add package
Projects
None yet
Milestone
No milestone
Development
Shows branches and pull requests linked to this issue.
Helpful resources
GitHub Community Guidelines

CHAPTER

FOUR

PIPELINE RELEASES

Note: A working `conda` installation (Miniconda, Mamba, Anaconda, etc.) is required (see *Install Conda*).

Warning: `stenv` does not support Python 2.

Warning: `stenv` does not support 32-bit operating systems.

Pipeline releases differ from the standard software stack and serve a different purpose. The release files, described below, are immutable snapshots of STScI operational software and can be used to replicate the environment used by STScI to perform mission-specific data processing. Be aware that upgrading packages with `conda update` is not recommended, as it will likely introduce unwanted bugs and / or break the environment all together.

If you have any questions, comments, or concerns related to pipeline releases, please feel free to contact help@stsci.edu

4.1 Installation

Pipeline release installations use the following `conda create` command format:

```
conda create -n demo_2016.1 --file http://ssb.stsci.edu/releases/hstdp/2016.1/hstdp-2016.
↪1-linux-py35.0.txt
conda activate demo_2016.1
```

Warning: The URL shown in this example does not reflect the latest iteration available. Please consult the *File URLs* section to ensure you are installing the correct release.

4.2 File URLs

Select the URL that matches your intended platform and environment.

4.2.1 HST Data Processing (HSTDP)

HSTDP was previously known as *OPUS*.

Instructions for installation of each delivery may be found in the respective subdirectories of the releases repository: https://github.com/astroconda/astroconda-releases/tree/master/caldp

Warning: The repository is located within the Astroconda GitHub organization for legacy reasons. Astroconda is no longer supported as of **February 1st, 2023**.

```
20221010
20220527
20220406
20220214
20220127
20211129
20211119
20210928
20210827
20210721
20210505
20210415
20210323
20201208
20201012
20200812
20200708
20200611
20200421
20200323
```

Historical deliveries used an older naming convention: https://github.com/astroconda/astroconda-releases/tree/master/hstdp

```
2019.5.2
2019.5.1
2019.5
2019.4
2019.3c
2019.3b
2019.3a
2019.3
2019.2
2018.3a
2018.3
2018.1
2017.3
```

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```
2017.2a
2017.2
2017.1
2016.2
2016.1
```

4.3 Continuous Integration

This example BASH function provides a starting point for users intending to execute pipeline software from within a continuous integration environment. This installation method is unsupported and your mileage may vary. Use at your own risk.

```
function get_pipeline()
{
    # Do we have enough arguments?
    if [[ $# < 3 ]]; then
        echo "Not enough arguments."
        return 1
    fi

    # Setup basic argument list     & Example Input(s)
    local conda_env="$1"            # hst_env
    local name="$2"                 # hstdp, ...
    local build="$3"                # 2017.2, 2016.2 ...
    local python_version="$4"       # py[35, 27, ...]
    local iteration="$5"            # final | post[0, 1, 2, ...]

    # Detect platform
    local _platform=$(uname -s)
    local platform=""

    # Convert platform string to match file naming convention
    if [[ ${_platform} == Linux ]]; then
        platform="linux"
    elif [[ ${_platform} == Darwin ]]; then
        platform="osx"
    else
        echo "Unsupported platform: ${_platform}"
        return 1
    fi
    unset _platform

    # Handle optional arguments.
    if [[ -z ${python_version} ]]; then
        # Notice the "py" prefix and condensed version here
        python_version="py35"
    fi

    if [[ -z ${iteration} ]]; then
        iteration="final"
```

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```
    fi

    # Assemble pipeline spec file URL
    local ac_root="http://ssb.stsci.edu/releases"
    local ac_base="${ac_root}/${name}/${build}"
    local ac_spec="${name}-${build}-${platform}-${python_version}.${iteration}.txt"
    local ac_url="${ac_base}/${ac_spec}"

    # Perform installation
    conda create -q -n "${conda_env}" --file "${ac_url}"
    return $?
}

#
# Usage example:
#

# Silently generate a pipeline environment called "hst_env"
get_pipeline hst_env hstdp 2017.2

# Enter environment
source activate hst_env

# ... do work ...
# EOF
```

CHAPTER

FIVE

WINDOWS SUPPORT

`stenv` does not currently support Windows, as `hstcal`, `fitsverify`, and the `jwst` calibration pipeline are not built or tested on Windows platforms.

If you would like to run `stenv` on Windows, you can use the *Windows Subsystem for Linux (WSL)*, an optional Windows feature that provides a functioning Linux terminal with access to the host operating system.

After installing your Linux system, install `stenv` by following the *Getting Started* instructions.

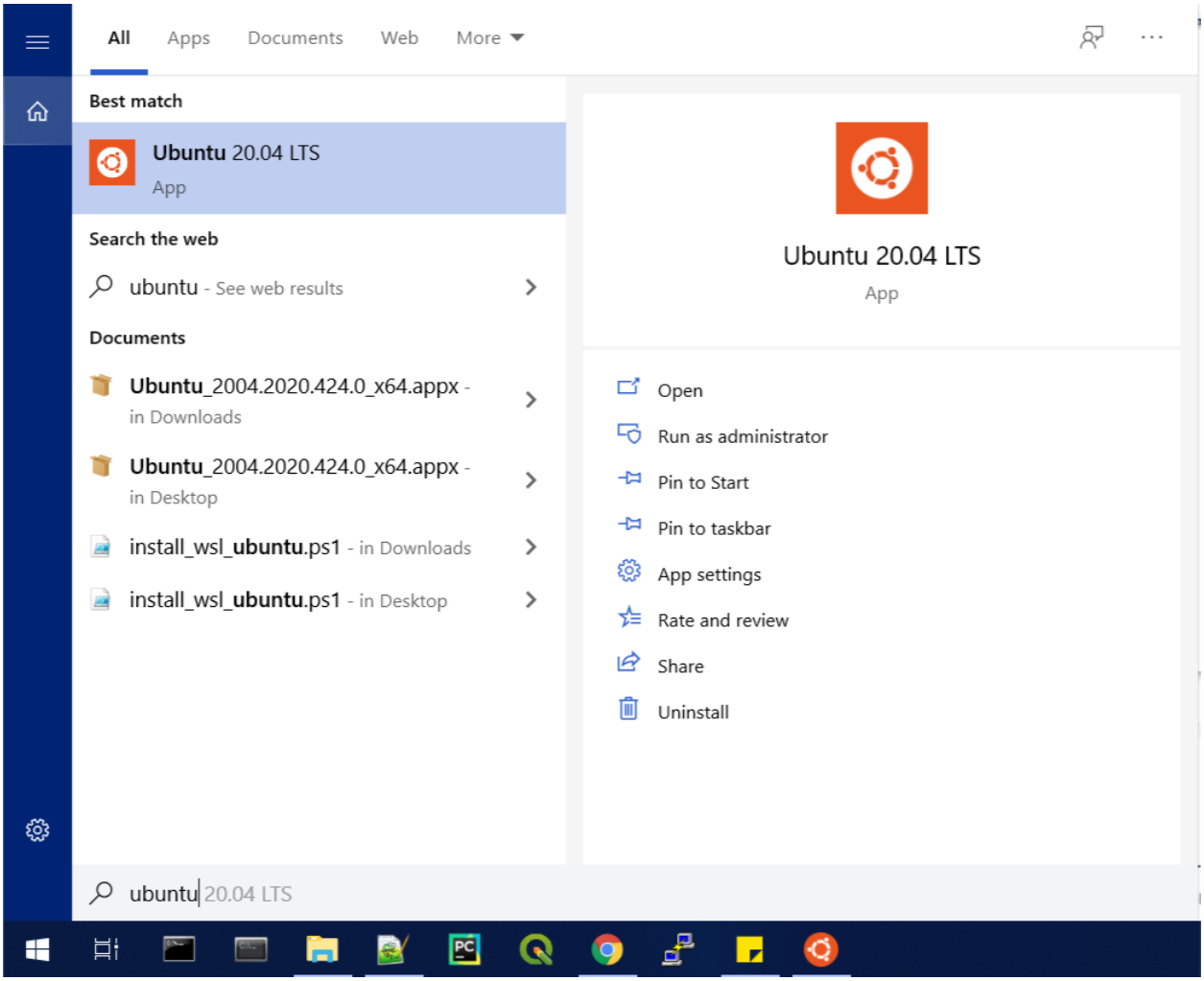
5.1 Windows Subsystem for Linux (WSL)

Windows Subsystem for Linux (WSL) is a platform provided by Microsoft onto which a Linux distribution (i.e. Ubuntu) can be installed. It provides a Linux shell within Windows that contains a functional Linux operating system, and thus can compile and run programs meant for Linux within that environment.

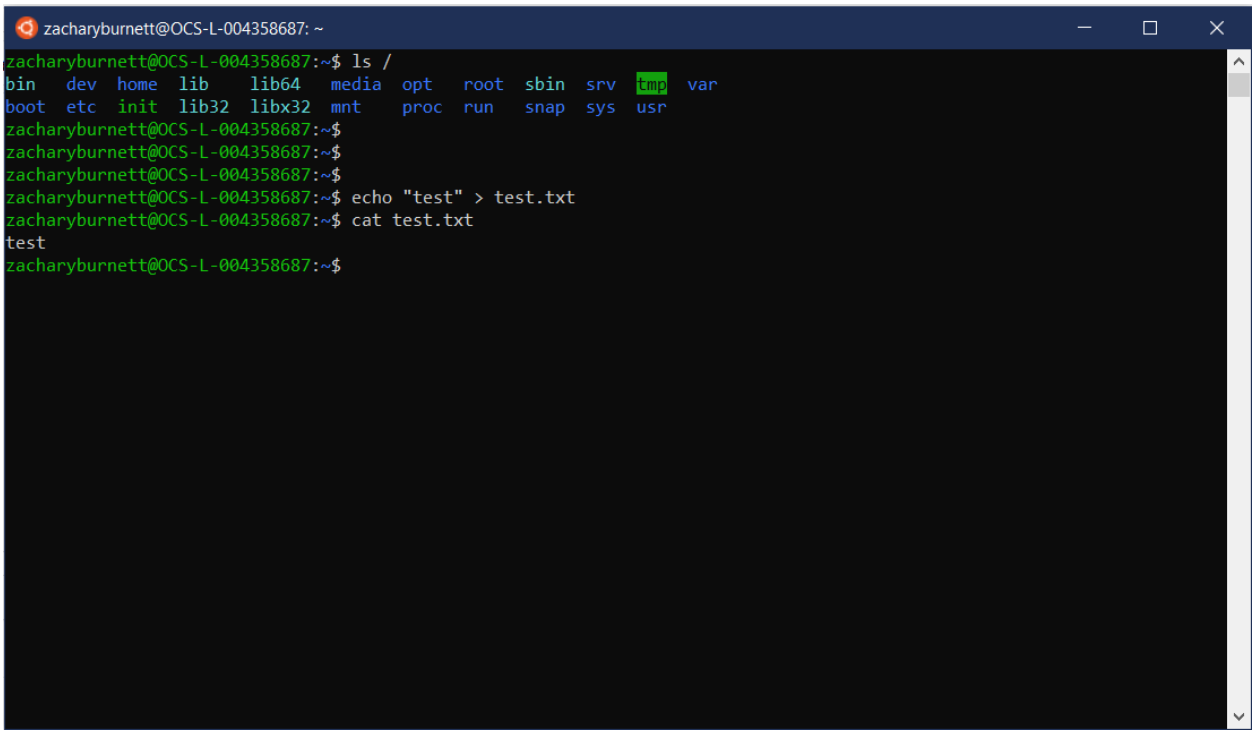
To install WSL on your machine, follow Microsoft's provided installation instructions:

```
wsl --install
```

Now, type `Ubuntu` (or whatever other distribution you chose) into the Start Menu:



This will boot the operating system and start the installation within WSL, after which it will prompt you to set a username and password.



After installation completes, you now have a functional Linux operating system that you can access in the same way.

You have access to many Windows utilities from within the Linux shell, and many WSL utilities from the Windows shell. By default, the Windows partition is mounted at `/mnt/c`.

Microsoft provides documentation on interoperability between Windows and WSL.

If you have issues with `stenv`, please create a new GitHub issue or contact one of the following help desks:

- **HST Help Desk:** https://stsci.service-now.com/hst
- **JWST Help Desk:** https://stsci.service-now.com/jwst