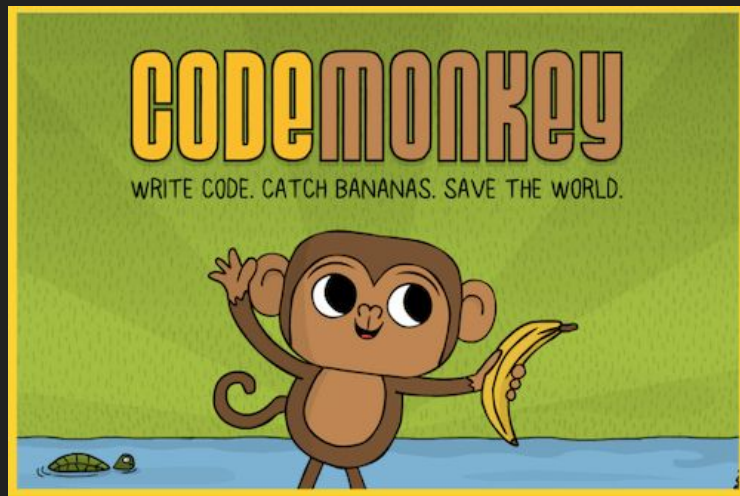
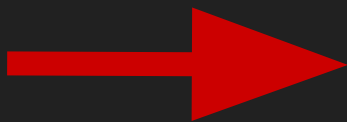


How to Boost Your Productivity

(& Distract Yourself From your PhD)

Paddy Roddy



Talk Warnings



Follow Along

git clone [git@github.com](https://github.com/paddyroddy/postgrad_physics_tutorial.git):paddyroddy/postgrad_physics_tutorial.git



Or

git clone https://github.com/paddyroddy/postgrad_physics_tutorial.git



ssh keys

Do you find yourself logging in with your git credentials every time you clone a private repo (this was the second method on the last slide)?

Get these set up once and you can use them always!

Passwordless ssh

```
klar (11:39) ~->ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ylo/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ylo/.ssh/id_rsa.
Your public key has been saved in /home/ylo/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:Up6KjbnEV4Hgfo75YM393QdQsK3Z0aTNBz0DoirrW+c ylo@klar
The key's randomart image is:
+---[RSA 2048]----+
|      .      ..OO..|
|      . . . . .O.X.|
|      . . O.  ..+ B|
|      .  O.O  .+ ..|
|      ..O.S  O..|
|      . %O=      .|
|      @.B...     .|
|      O.=. O. . . .|
|      .OO  E. . . .|
+---[SHA256]-----+
klar (11:40) ~->
```

ssh config

- Configure in ~/.ssh/config
- Rather than using ssh ubuntu@18.132.19.208 every time
- ssh mlbd
- Combined with ssh keys on the previous slide you can speed up logging into machines

```
24  
25 Host mlbd  
26     Hostname 18.132.19.208  
27     User ubuntu  
28
```

git

General workflow:

- `git status`
- `git add <name_of_file>`
- `git commit`
- `git push`

Tips:

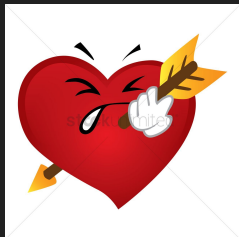
- commit often, backup of your work
- `git add -p <name_of_file>` allows you to pick certain lines



shell

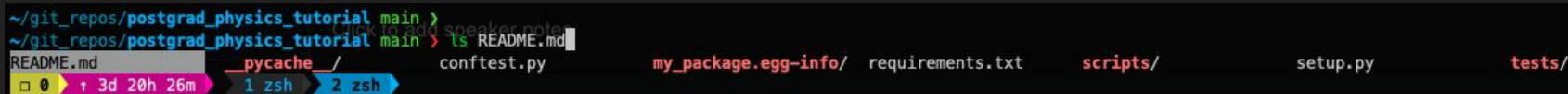
- echo \$0 if you are not sure
- Linux tends to default to bash
- Mac used to default to bash, now to zsh
- Clusters may use something else i.e. csh/tcsh
- Can look in /etc/shells to see what is available
- Change shell with chsh -s \$(which zsh)

- Windows?



Why you should use zsh (i.e. bash++)

- Don't have to write cd every time
- Lots of useful plugins & aliases
- Basically the same syntax but less verbose
- Nice tab completion
- Many more



A terminal window showing a zsh shell. The prompt is `~/git_repos/postgrad_physics_tutorial main >`. The user has typed `ls` and is seeing a list of files: `README.md`, `__pycache__`, `conftest.py`, `my_package.egg-info/`, `requirements.txt`, `scripts/`, `setup.py`, and `tests/`. The terminal also shows a history of commands: `1 zsh` and `2 zsh`. There are also some status indicators at the bottom left: a yellow square with a black circle, a red arrow, and a green arrow.

Dotfiles - stop using boring defaults

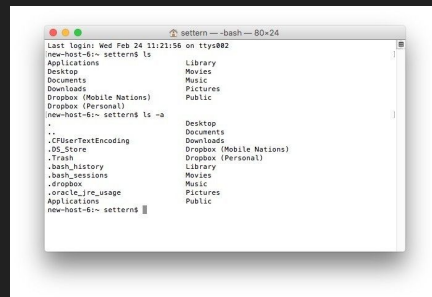
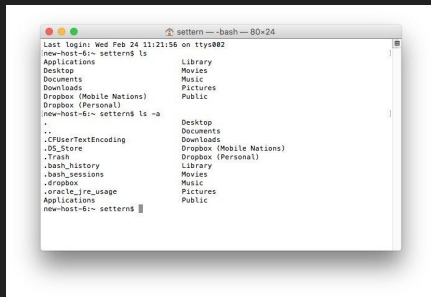
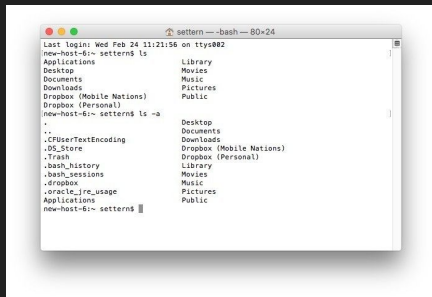
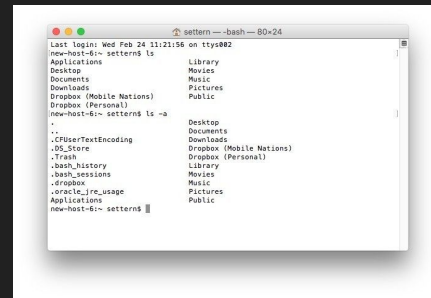
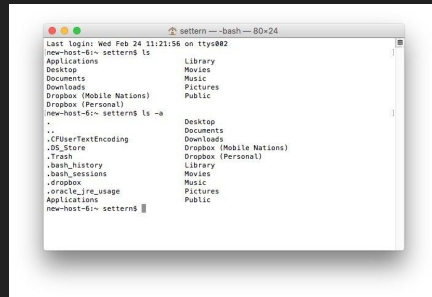
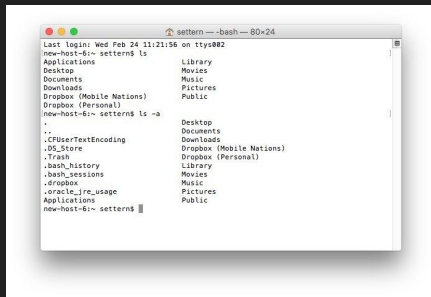
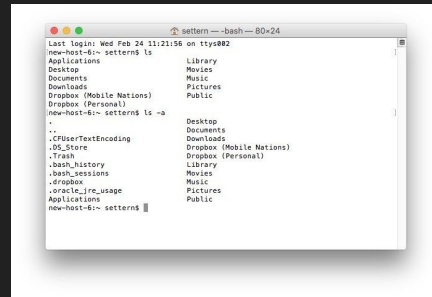
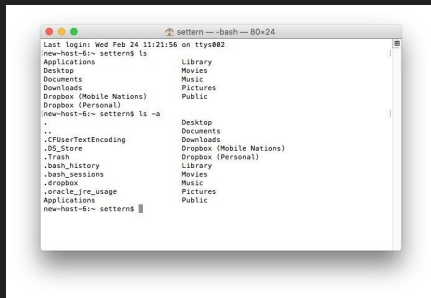
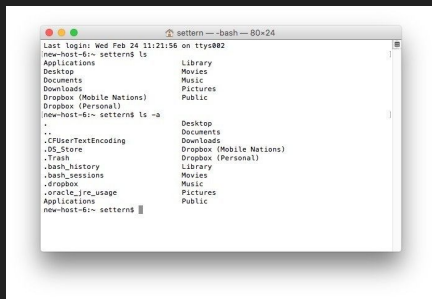
- <https://github.com/paddyroddy/dotfiles>
- Can install on any cluster so you always have a nice terminal
- Use GNU stow to symlink to your home directory
- If using zsh then you just need a .zshrc file (forget about .profile/.bashrc)

```
cd $HOME/dotfiles && stow -v conda git ipython neovim tmux zsh
```

```
28
29 # Which plugins would you like to load?
30 # Standard plugins can be found in ~/.oh-my-zsh/plugins/*
31 # Custom plugins may be added to ~/.oh-my-zsh/custom/plugins/
32 # Example format: plugins=(rails git textmate ruby lighthouse)
33 # Add wisely, as too many plugins slow down shell startup.
34 plugins=(
35     common-aliases
36     fast-syntax-highlighting
37     git
38 )
```

git commands can become

- gst (git status)
- ga (git add)
- gc (git commit)
- gp (git push)



tmux

- Multiple windows with multiple panes within each
 - Allows you to run a long command on a cluster without having to remain logged in (by detaching)
 - Customised by .tmux.conf
 - Inspired?
- <https://github.com/paddyroddy/tmux>

```
isort: (no files to check) Passed
Fix End of Files..... Passed
Trim Trailing Whitespace..... Passed
flake8..... (no files to check) Skipped
black..... (no files to check) Skipped
mypy..... (no files to check) Skipped
[main 230cb35] Build script on CI
2 files changed, 44 insertions(+), 2 deletions(-)
~/git_repos/postgrad_physics_tutorial main *1 > gp

Enumerating objects: 11, done.
Counting objects: 100% (11/11), done.
Delta compression using up to 4 threads
Compressing objects: 100% (4/4), done.
Writing objects: 100% (6/6), 993 bytes | 993.00 KiB/s, done.
Total 6 (delta 2), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (2/2), completed with 2 local objects.
To github.com:paddyroddy/postgrad_physics_tutorial.git
  2b8da20..230cb35  main -> main
~/git_repos/postgrad_physics_tutorial main > echo $?
0
~/git_repos/postgrad_physics_tutorial main > echo $!
48286
~/git_repos/postgrad_physics_tutorial main > echo $0
-zsh
~/git_repos/postgrad_physics_tutorial main > cat /etc/shells
# List of acceptable shells for chpass(1).
# Ftpd will not allow users to connect who are not using
# one of these shells.

/bin/dash
/bin/sh
/bin/dash
/bin/ksh
/bin/sh
/bin/tcsh
/bin/zsh
~/git_repos/postgrad_physics_tutorial main >
~/git_repos/postgrad_physics_tutorial main > ls

Deploying to postgrad_physics_tutorial main >
1 deploy.yml x 1 test_demo.py 1 deploy.yml x 1 scripts > 1 steps > 1 3 > run

- name: Checkout source
  uses: actions/checkout@v2

- name: Set up Python
  uses: actions/setup-python@v2
  with:
    python-version: 3.8

- name: Restore python cache
  uses: actions/cache@v2
  with:
    path: ${env.pythonLocation}
    key: ${hashFiles('requirements.txt')}

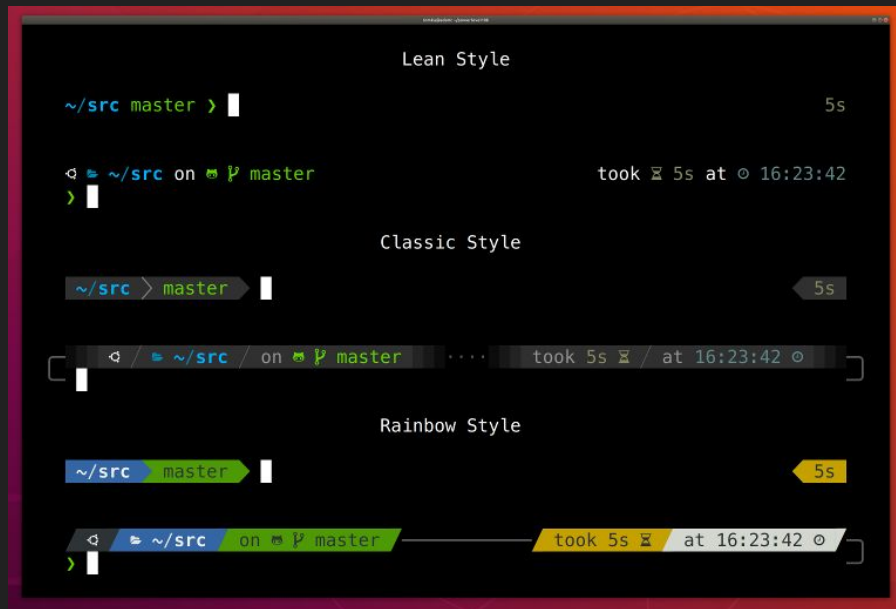
- name: Install dependencies
  run: |
    python -m pip install --upgrade pip
    pip install -r requirements.txt

- name: Build postage
  run: |
    pip install -e .

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
1 deploy.yml github/workflows 3
Property name is not allowed. yamlschema: https://raw.githubusercontent.com/DeployPH/deployer/master/arc/schema.json [1, 1]
Property on is not allowed. yamlschema: https://raw.githubusercontent.com/DeployPH/deployer/master/arc/schema.json [3, 1]
Property jobs is not allowed. yamlschema: https://raw.githubusercontent.com/DeployPH/deployer/master/arc/schema.json [5, 1]
README.md 4
isort: suggestions: sort spelling [7, 13]
This sentence does not start with an uppercase letter. [Tox - UPPER_CASE_SENTENCE] [11, 13]
isort: Possible fix: [py38:11:63:15] [Tox - MORFOLOGIK_RULE_EN_US] [13, 15]
SyntaxError: Unexpected token 'in' in JSON at position 0
This sentence does not start with an uppercase letter. [Tox - UPPER_CASE_SENTENCE] [15, 15]
87% < 12:06 < 03 Dec < paddy < paddy
```

Prompt

- <https://github.com/romkatv/powerlevel10k>
- Very useful having the git feature to remind which branch you're on



How to install stuff on a cluster without sudo?

- Brew to the rescue
- Originally on mac (I use this over ports)
- `/bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"`
- Install at `~/.linuxbrew`
- Then you can install everything you need without having to ask the cluster admin everytime



Notebooks are for play, not for development...

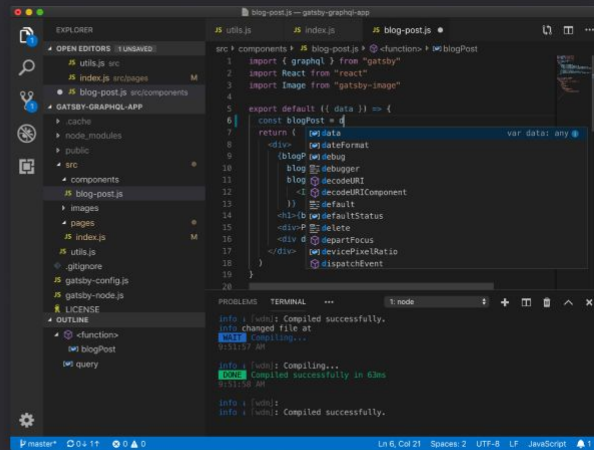
- Great for teaching
- Useful for exploring
- Terrible integration with git
- Cannot easily build sophisticated code
- Notebook state is unique to notebooks, can cause far more bugs than writing in python



One (well two) editor(s) to rule them all!



neovim



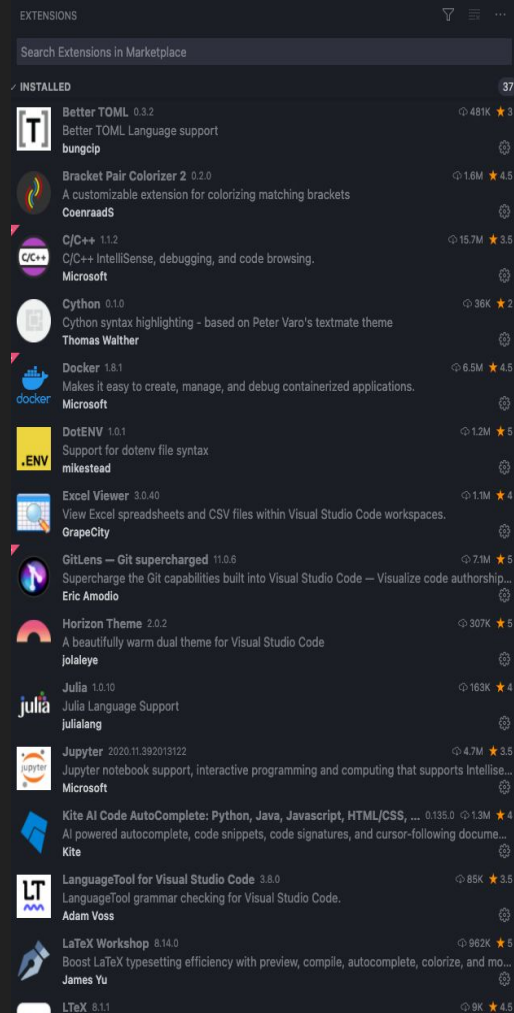
Vim

- Useful to learn one terminal based editor
- Useful when working on clusters (over ssh) and making quick local edits
- I use neovim (have used `alias vim='nvim'` in my dotfiles)
- A basic system will always have `vi` installed so can guarantee you can use it
- How to exit? `:q!`
- How to save and exit? `ZZ` i.e. capital letters
- Many shortcuts
- Many plugins
- IMO not for *serious* development

vscode

- Many open source extensions
- Allows you to code in basically all languages (i.e. python through to latex)
- Can sync your settings over GitHub if working on multiple computers
- Magic commands let you i.e. debug your tests

```
5
6
Run Test | Debug Test
7 def test_fill_matrix_using_hermitian_relation() → None:
8     """
9     test that Hermitian symmetry is applied to matrix
10    """
11    matrix_in = np.array(
12        [[1 + 1i, 0, 0], [4 + 4i, 5 + 5i, 0], [7 + 7i, 8 + 8i, 9 +
```



pre-commit

- pip install pre-commit
- pre-commit install
- Will install hooks in the .git/ directory
- Stops you committing bad code!
- .pre-commit-config.yaml file

```
~/project/src/s2sleplet develop +2 *3 +3 > gc
isort.....Failed
- hook id: isort
- files were modified by this hook

Fixing /Users/paddy/project/src/s2sleplet/pys2sleplet/slepian/slepian_region/slepian_arbitrary.py

Fix End of Files.....Passed
Trim Trailing Whitespace.....Passed
flake8.....Passed
black.....Passed
mypy.....Passed
```

repos:

- repo: <https://github.com/pycqa/isort>
rev: 5.6.4
hooks:
 - id: isort
types: [text]
types_or: [python, cython]
args: ["--profile", "black"]
- repo: <https://github.com/pre-commit/pre-commit-hooks>
rev: v3.2.0
hooks:
 - id: end-of-file-fixer
 - id: trailing-whitespace
- repo: <https://gitlab.com/pycqa/flake8>
rev: 3.8.4
hooks:
 - id: flake8
- repo: <https://github.com/ambv/black>
rev: stable
hooks:
 - id: black
- repo: <https://github.com/pre-commit/mirrors-mypy>
rev: v0.790
hooks:
 - id: mypy

Mypy = python + type annotations

- Python is easy but slow and error prone
- Typing introduced in 3.6
- Pretty basic and a pain to do the first time but I now always do it
- mypy verifies that your code types are satisfied i.e. `ind: int` it verifies that `ind` is always treated as an integer

```
from typing import Callable

import numpy as np
import pysht as ssht
from numpy.random import Generator

from pys2sleplet.utils.vars import SAMPLING_SCHEME

def create_spherical_harmonic(L: int, ind: int) → np.ndarray:
    """
    create a spherical harmonic in harmonic space for the given index
    """
    flm = np.zeros(L ** 2, dtype=np.complex128)
    flm[ind] = 1
    return flm

def boost_coefficient_resolution(flm: np.ndarray, boost: int) → np.ndarray:
    """
    calculates a boost in resolution for given flm
    """
    return np.pad(flm, (0, boost), "constant")

def invert_flm_boosted(
    flm: np.ndarray, L: int, resolution: int, reality: bool = False, spin: int = 0
) → np.ndarray:
    """
    performs the inverse harmonic transform
    """
    boost = resolution ** 2 - L ** 2
    flm = boost_coefficient_resolution(flm, boost)
    return ssht.inverse(
        flm, resolution, Reality=reality, Spin=spin, Method=SAMPLING_SCHEME
    )
```

Python Packages

- Rather than always running `python my_script.py` or `python -m my_folder.sub_folder.my_script.py` everytime you can create a command line tool
- Can also build cython code - which basically allows you to wrap faster C/C++ code and run it in python

8 lines (7 sloc) | 219 Bytes

```
1 from setuptools import find_namespace_packages, setup
2
3 setup(
4     name="my_package",
5     version="0.1.0",
6     packages=find_namespace_packages(),
7     entry_points=dict(console_scripts=["woo=scripts.my_script:main"]),
8 )
```

```
1 from Cython.Build import cythonize
2 from setuptools import Extension, find_namespace_packages, setup
3
4 setup(
5     name="pys2sleplet",
6     version="0.1.0",
7     author="Patrick Roddy",
8     author_email="patrickjamesroddy@gmail.com",
9     packages=find_namespace_packages(),
10    include_package_data=True,
11    entry_points=dict(console_scripts=["plotting=pys2sleplet.scripts.
12    plotting:main"]),
13    ext_modules=cythonize(
14        Extension("slepiant_computations", ["pys2sleplet/cython/*.pyx"]),
15        annotate=True,
16        language_level=3,
17        compiler_directives=dict(boundscheck=False, embedsignature=True),
18    ),
19 )
```

You, 19 hours ago · Don't use Cython but keep

Testing (e.g. in python but applicable everywhere)

- Always test your code!
- Try and test individual functions as much as possible
- Can also test the result of a whole script i.e. input with expected output
- Very helpful to stop introducing bugs
- Can get it tested on CI so you don't forget
- In python i.e. `pytest -v`

```
1  import pytest
2
3
4  def test_something(demo_fixture) -> None:
5      """
6      tests checks that something exists
7      """
8      assert isinstance(demo_fixture, str)
9      assert len(demo_fixture) > 0
10
11
12  @pytest.mark.slow
13  def test_slow_test(runs) -> None:
14      """
15      this will only be executed if --runslow test is passed to pytest
16      please don't ever right a test like this haha
17      """
18      old = -1
19      for new in range(runs):
20          assert new > old
21          old = new
```



docker

- Allows you to run on a clean installation of i.e. ubuntu
- Work out bare minimum steps needed to install your code
- Just need a **Dockerfile** which has its own unique syntax
- Can help to pass your code to someone to guarantee that they can run it with the same setup as you
- Your work in a container (subtly different to a VM)

```
1 FROM alpine AS stage1
2 LABEL maintainer="paddyroddy.github.io"
3
4 # environment variables
5 ENV HOME /home
6 ENV SSSH $HOME/ssht
7 ENV S03 $HOME/so3
8 ENV S2LET $HOME/s2let
9
10 # install git
11 RUN apk --no-cache add -t .build-dep \
12     git \
13     openssh-client \
14     wget
15
16 # private repos
17 ARG SSH_PRIVATE
18 RUN mkdir /root/.ssh/
19 RUN echo "$SSH_PRIVATE" > /root/.ssh/id_rsa
20 RUN chmod 400 /root/.ssh/id_rsa
21 RUN touch /root/.ssh/known_hosts
22 RUN ssh-keyscan github.com >> /root/.ssh/known_hosts
23
24 # ssht
25 RUN git clone git@github.com:astro-informatics/src_ssht.git $SSHT
26 WORKDIR $SSHT
27 RUN git checkout paddy
28
29 # so3
30 RUN git clone git@github.com:astro-informatics/src_so3.git $S03
31 WORKDIR $S03
32 RUN git checkout paddy
33
34 # s2let
35 RUN git clone git@github.com:astro-informatics/src_s2let.git $S2LET
36 WORKDIR $S2LET
37 RUN git checkout paddy
38
39 # CFITSIO
40 WORKDIR $HOME
41 RUN wget \
42     http://heasarc.gsfc.nasa.gov/FTP/software/fitsio/c/cfitsio_latest.tar.gz \
43     && tar xzf cfitsio_latest.tar.gz && rm cfitsio_latest.tar.gz \
44     && mv cfitsio* $(echo cfitsio* | awk -F'[-]' '{print $1}')
```

Continuous Integration (CI)

- Incredibly useful/important and free!
- GitHub allow unlimited use of public repos & 2000 minutes/month for private
- Helps you to work out the bare minimum a user needs to install to run your code
- Helps you find out if you've broken your code



Travis CI



GitHub Actions

- i.e. `.github/workflows/deploy.yml` but can have any name

```
name: Tests

on: [push, pull_request]

jobs:
  tests:
    runs-on: ubuntu-latest
    steps:
      - name: Checkout source
        uses: actions/checkout@v2

      - name: Set up Python
        uses: actions/setup-python@v2
        with:
          python-version: 3.8

      - name: Restore python cache
        uses: actions/cache@v2
        with:
          path: ${env.pythonLocation}
          key: ${hashFiles('requirements.txt')}

      - name: Install dependencies
        run: |
          python -m pip install --upgrade pip
          pip install -r requirements.txt

      - name: Test with pytest
        run: |
          pytest -v --runslow
```

```
name: Build LaTeX

on: [push, pull_request]

jobs:
  textidate:
    runs-on: ubuntu-latest
    steps:
      - name: checkout source
        uses: actions/checkout@v2

      - name: Set up Java
        uses: actions/setup-java@v1
        with:
          java-version: 15

      - name: Download textidate
        run: |
          wget https://github.com/sylvainhalle/textidate/releases/
            download/v0.8.1/textidate.jar

      - name: analyse files
        run: |
          for file in $(ls *.tex); do \
            echo $file; \
            java -jar textidate.jar $file; \
          done

vale_run:
  runs-on: ubuntu-latest
  steps:
    - name: checkout source
      uses: actions/checkout@v2

    - name: Vale
      uses: errata-ai/vale-action@v1.3.0
      with:
        files: |
          [
            "background.tex",
          ]
      env:
        GITHUB_TOKEN: ${secrets.GITHUB_TOKEN}
```

```
chktex_and_deploy:
  runs-on: ubuntu-latest
  steps:
    - name: checkout source
      uses: actions/checkout@v2

    - name: Build PDF
      uses: xu-cheng/texlive-action/full@v1
      with:
        run: |
          for file in $(ls *.tex); do \
            echo $file; \
            latexmk -quiet -pdf $file; \
          done

    - name: Set up Dropbox
      run: |
        echo "OAUTH_ACCESS_TOKEN=${OAUTH_ACCESS_TOKEN}" > ~/.
          dropbox_uploader

      env:
        OAUTH_ACCESS_TOKEN: ${secrets.OAUTH_ACCESS_TOKEN}

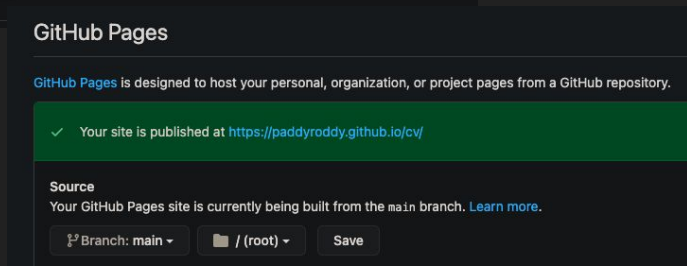
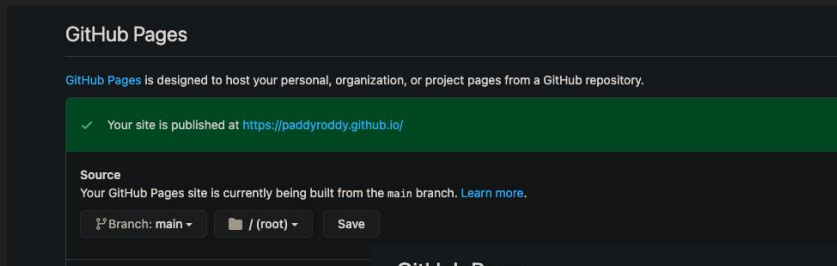
    - name: Upload PDFs
      run: |
        for file in $(ls *.tex | sed -e 's/\.tex//'); do \
          echo $file; \
          ./dropbox_uploader.sh upload $file.pdf $file.pdf; \
        done

    - name: Run chktx
      uses: xu-cheng/texlive-action/full@v1
      with:
        run: |
          for file in $(ls *.tex); do \
            echo $file; \
            chktx $file | tee /dev/stderr | (! grep -q ^); \
          done
```

```
1 name: deploy
2
3 on:
4   push:
5     tags:
6       - "*"
7
8 jobs:
```

Build Your Own Website for Free

- Demo <https://paddyroddy.github.io/> code: <https://github.com/paddyroddy/paddyroddy.github.io>
- Can customise the URL if you have a domain name



```
1 name: Build and Deploy
2 on:
3   push:
4     branches:
5       - release
6   pull_request:
7     branches:
8       - release
9   schedule:
10    - cron: "0 12 * * *"
11 jobs:
12   build-and-deploy:
13     runs-on: ubuntu-latest
14     steps:
15       - name: checkout source
16         uses: actions/checkout@v2
17
18       - name: Set up Ruby
19         uses: ruby/setup-ruby@v1
20         with:
21           ruby-version: 2.7
22           bundler-cache: true
23
24       - name: Install and Build
25         run: |
26           JEKYLL_ENV=production bundle exec jekyll build --destination site
27
28   - name: Deploy
29     uses: peaceiris/actions-gh-pages@v3
30     with:
31       github_token: ${ secrets.GITHUB_TOKEN }
32       publish_dir: ./site
33       publish_branch: main
34       user_name: Deployment Bot
35       user_email: deploy@travis-ci.org
```

