



Python for data science  
(and the other sciences):  
Your new **superpower**

# Where we are headed



# Should you be a programmer?

In 2020, an estimated 1 million computer **programming-related jobs** in the **US** are expected to be **unfilled**. Many tech organizations are now turning to non-traditional applicants and internal training to fill these gaps. About 58% of all STEM (Science, Technology, Engineering, Mathematics) are in computing. Jan 17, 2019

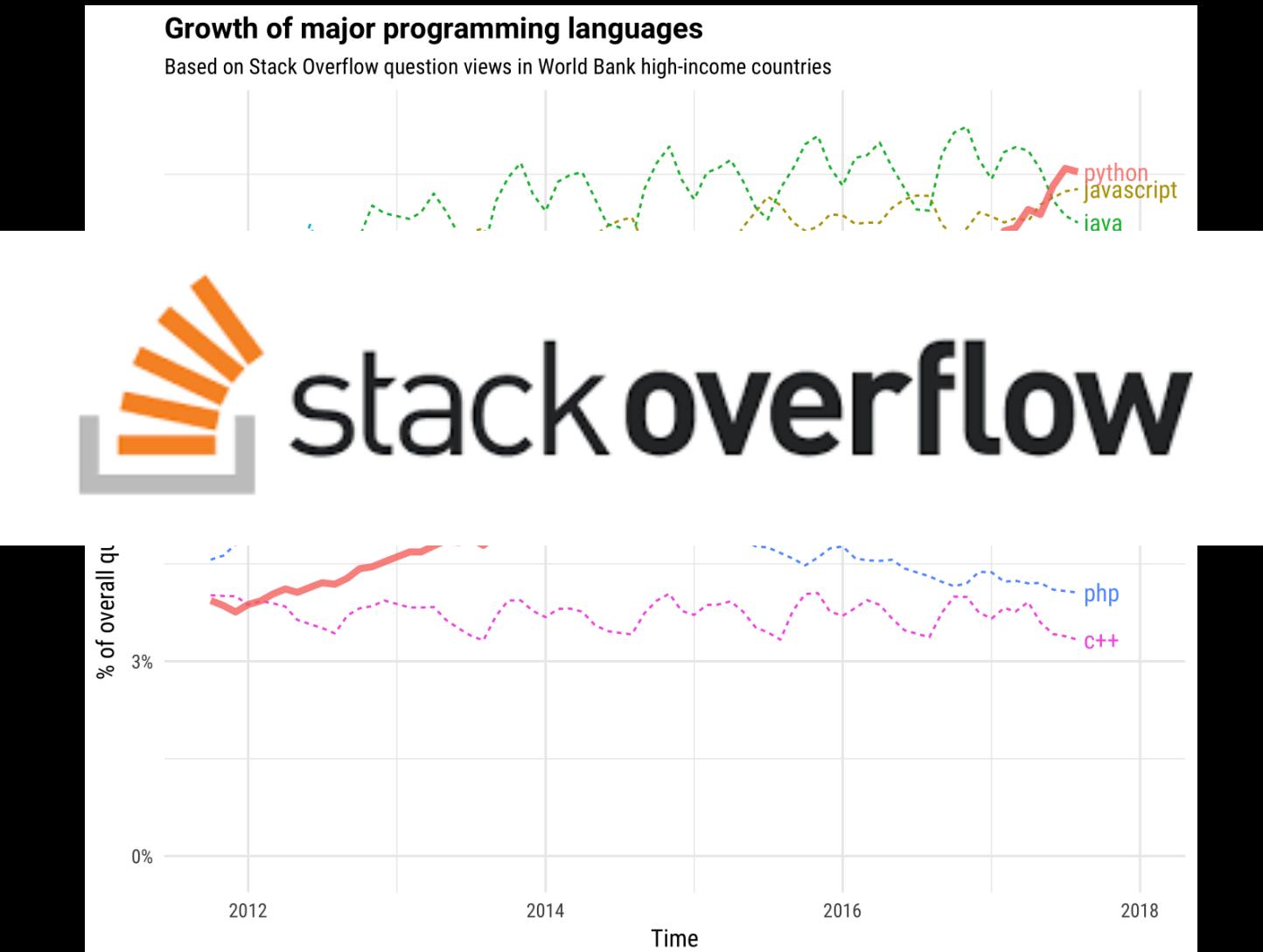
**Talent Shortage of Software Developers - Full Scale**

<https://fullscale.io/talent-shortage-software-developers>

# Programming is a super power

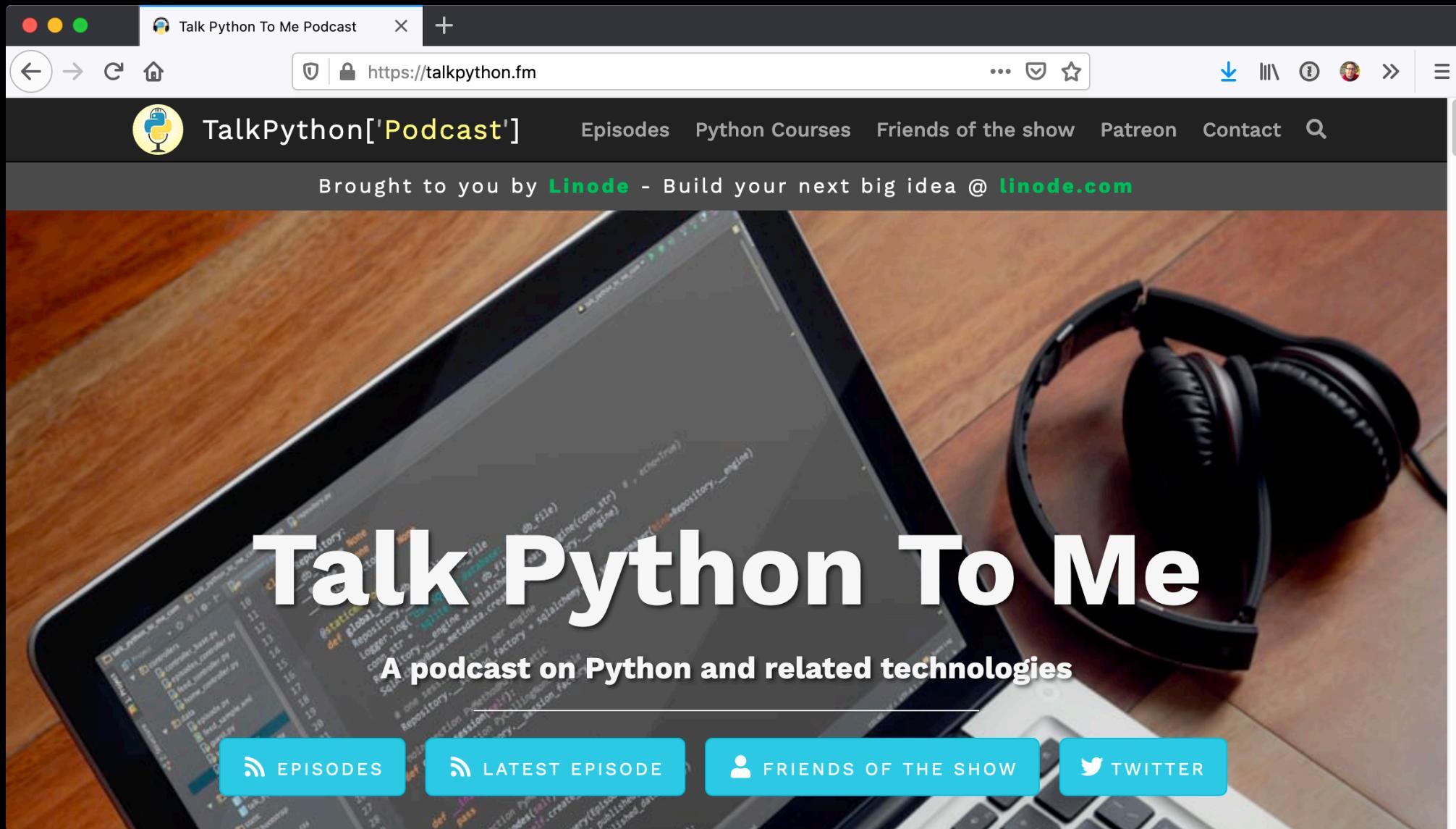


# Why Python?



<https://stackoverflow.blog/2017/09/06/incredible-growth-python/>

# Stories

A screenshot of a web browser displaying the homepage of the Talk Python To Me Podcast website. The page features a large banner image of a laptop screen showing Python code and a pair of headphones resting on a wooden surface. Overlaid on the banner is the title "Talk Python To Me" in a large, white, sans-serif font. Below the title is the subtitle "A podcast on Python and related technologies". At the top of the page is a dark navigation bar with the website's logo, "TalkPython['Podcast']", and links for "Episodes", "Python Courses", "Friends of the show", "Patreon", "Contact", and a search icon. The URL "https://talkpython.fm" is visible in the browser's address bar. A promotional banner at the top of the main content area reads "Brought to you by Linode - Build your next big idea @ linode.com". At the bottom of the page are four blue call-to-action buttons: "EPISODES", "LATEST EPISODE", "FRIENDS OF THE SHOW", and "TWITTER".

TalkPython['Podcast']

Episodes Python Courses Friends of the show Patreon Contact

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# Talk Python To Me

A podcast on Python and related technologies

EPISODES LATEST EPISODE FRIENDS OF THE SHOW TWITTER

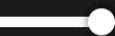
# Large Hadron Collider and CERN

## Episode #29: Python at the Large Hadron Collider and CERN

Published Tues, Oct 13, 2015, recorded Thurs, Sep 24, 2015.



0:00 / 0:00



Kyle Cranmer

(embed this episode via SoundCloud)

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[talkpython.fm/29](http://talkpython.fm/29)

# Large Hadron Collider and CERN

## Episode #144: Machine Learning at the Large Hadron Collider

Published Tues, Dec 26, 2017, recorded Thurs, Dec 14, 2017.



Panelists



0:00 / 0:00



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[talkpython.fm/144](http://talkpython.fm/144)

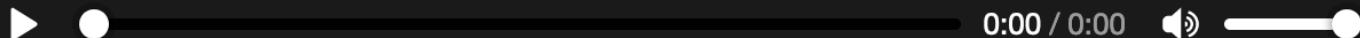
# Climate science

## Episode #134: Python in Climate Science

Published Thurs, Oct 19, 2017, recorded Mon, Oct 16, 2017.



Damien Irving



(embed this episode via  SoundCloud)

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[talkpython.fm/134](http://talkpython.fm/134)

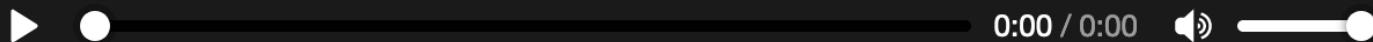
# Microbiome research

## Episode #237: A gut feeling about Python

Published Wed, Nov 6, 2019, recorded Fri, Sep 27, 2019.



Sebastian Proost



(embed this episode via  SoundCloud)

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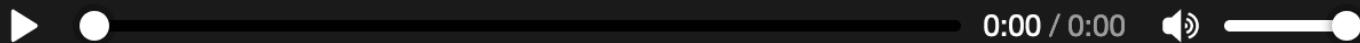
# Matlab or Python?

## Episode #201: Choosing JupyterHub and Python over MATLAB

Published Wed, Feb 27, 2019, recorded Wed, Jan 23, 2019.



Peter Kazarinoff

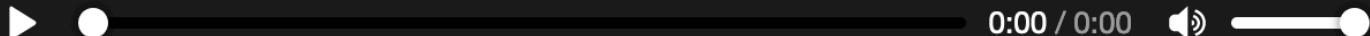


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[talkpython.fm/201](http://talkpython.fm/201)

## Episode #164: Python in Brain Research at the Allen Institute

Published Fri, Jun 1, 2018, recorded Fri, May 4, 2018.



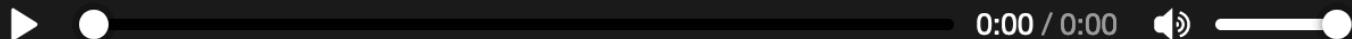
Panelists

(embed this episode via  SoundCloud)

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## Episode #236: Scaling data science across Python and R

Published Tues, Oct 29, 2019, recorded Fri, Sep 27, 2019.



0:00 / 0:00



Panelists

(embed this episode via SoundCloud)

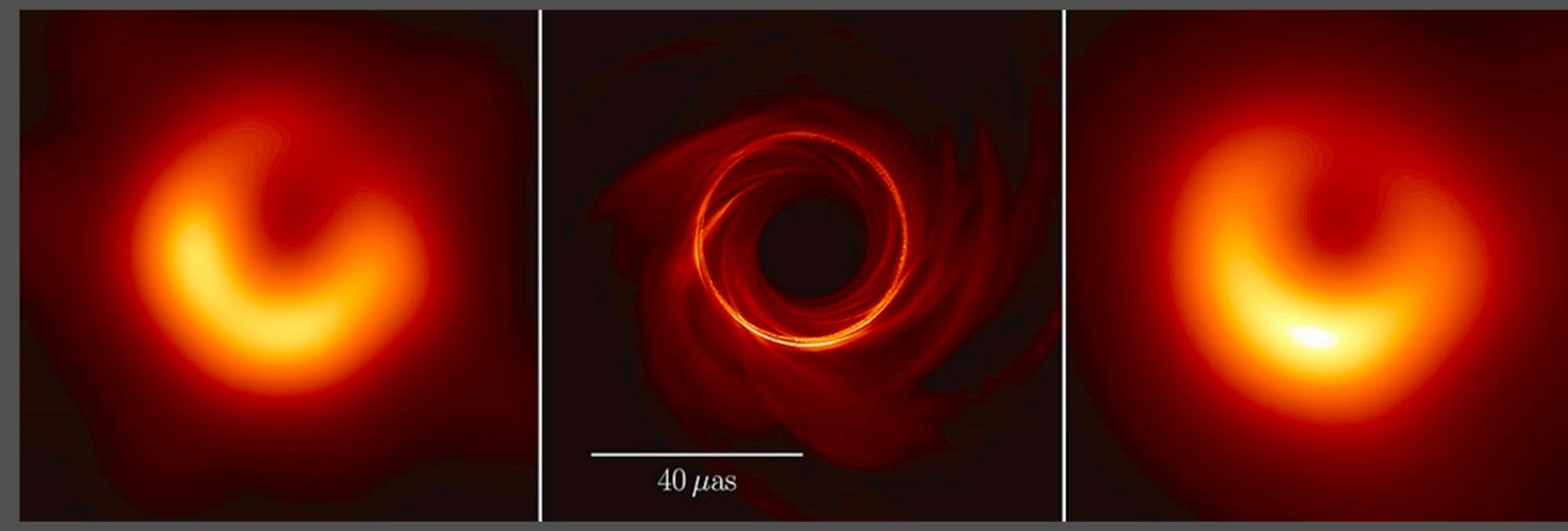
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# First image of a black hole



Main event: the image of the black hole at the centre of the Messier 87 galaxy shows the effect of the accretion disc as well as the black hole's shadow in the centre. (Courtesy: Akiyama *et al.* and *ApJL*)

# First image of a black hole

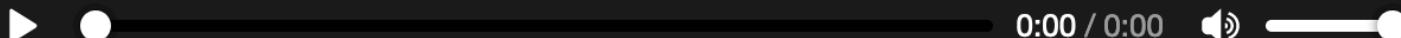


Shadowlands: From left to right, EHT observations of M87\* taken on 6 April 2017; a simulation of M87\*; simulation convoluted to the resolution of the Event Horizon Telescope. (Courtesy: Akiyama et al and ApJL)

# Medieval Islamic Philosophy

## Episode #230: Python in digital humanities research

Published Wed, Sep 18, 2019, recorded Tues, Aug 27, 2019.



0:00 / 0:00



Cornelis van Lit

(embed this episode via  SoundCloud)

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[talkpython.fm/230](http://talkpython.fm/230)



# Jupyter Notebooks and JupyterLab

The screenshot shows the JupyterLab interface running in a browser window. The title bar says "JupyterLab" and the address bar shows "localhost:8888/lab". The left sidebar contains a file tree with files like "counting\_domain.ipynb", "Lorenz.ipynb" (selected), "lorenz.py", and "requirements.txt". The main area displays a notebook cell titled "The Lorenz Differential Equations". The cell contains code to import matplotlib and ipywidgets, followed by a text block about exploring the Lorenz system. Below the text are three differential equations:

$$\begin{aligned}\dot{x} &= \sigma(y - x) \\ \dot{y} &= \rho x - y - xz \\ \dot{z} &= -\beta z + xy\end{aligned}$$

Text below the equations says "Let's change ( $\sigma$ ,  $\beta$ ,  $\rho$ ) with ipywidgets and examine the trajectories." A code cell imports solve\_lorenz from lorenz and creates an interactive widget w. Three sliders are shown for sigma (3.30), beta (1.63), and rho (36.20). At the bottom is a 3D plot of the Lorenz attractor.

Code snippets:

```
[6]: %matplotlib inline
from ipywidgets import interactive, fixed

[7]: from lorenz import solve_lorenz
w=interactive(solve_lorenz,sigma=(0.0,50.0),rho=(0.0,50.0))
w
```

Sliders:

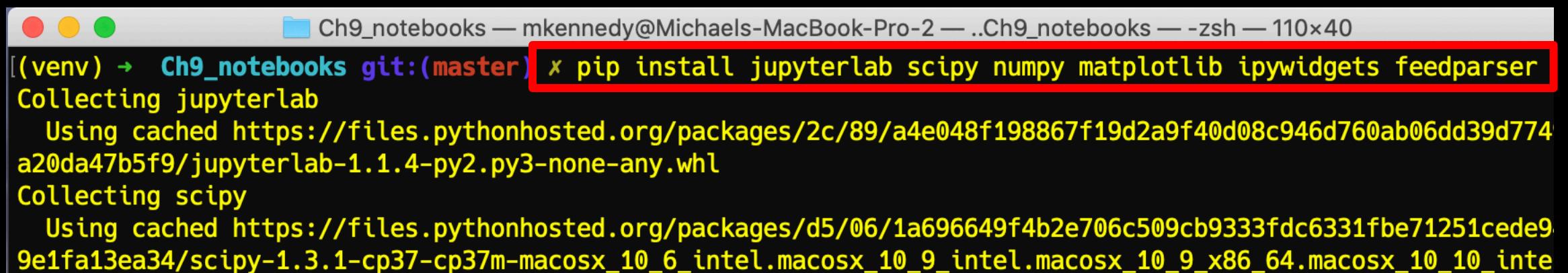
- sigma: 3.30
- beta: 1.63
- rho: 36.20

Figure:

# Getting started with JupyterLab: Step 1

```
[→ Ch9_notebooks git:(master) ✘ python3 -m venv venv
[→ Ch9_notebooks git:(master) ✘ . venv/bin/activate
(venv) → Ch9_notebooks git:(master) ✘ pip install -U pip setuptools
Collecting pip
  Using cached https://files.pythonhosted.org/packages/30/db/9e387601
e6514e675a1/pip-19.2.3-py2.py3-none-any.whl
Collecting setuptools
  Using cached https://files.pythonhosted.org/packages/6a/9a/50fadfd:
85758fa8b34/setuptools-41.4.0-py2.py3-none-any.whl
Installing collected packages: pip, setuptools
  Found existing installation: pip 19.0.3
    Uninstalling pip-19.0.3:
      Successfully uninstalled pip-19.0.3
  Found existing installation: setuptools 40.8.0
    Uninstalling setuptools-40.8.0:
      Successfully uninstalled setuptools-40.8.0
Successfully installed pip-19.2.3 setuptools-41.4.0
```

# Getting started with JupyterLab: Step 2



A screenshot of a macOS terminal window titled "Ch9\_notebooks — mkennedy@Michaels-MacBook-Pro-2 — .Ch9\_notebooks — -zsh — 110x40". The window shows a command-line session. A red box highlights the command `x pip install jupyterlab scipy numpy matplotlib ipywidgets feedparser`. The session output includes:

```
(venv) → Ch9_notebooks git:(master) x pip install jupyterlab scipy numpy matplotlib ipywidgets feedparser
Collecting jupyterlab
  Using cached https://files.pythonhosted.org/packages/2c/89/a4e048f198867f19d2a9f40d08c946d760ab06dd39d774
a20da47b5f9/jupyterlab-1.1.4-py2.py3-none-any.whl
Collecting scipy
  Using cached https://files.pythonhosted.org/packages/d5/06/1a696649f4b2e706c509cb9333fdc6331fbe71251cede9
9e1fa13ea34/scipy-1.3.1-cp37-cp37m-macosx_10_6_intel.macosx_10_9_intel.macosx_10_9_x86_64.macosx_10_10_inte
```

# Getting started with JupyterLab: Step 3

```
Ch9_notebooks — mkennedy@Michaels-MacBook-Pro-2 — ..Ch9_notebooks — -zsh — 110x40
(venv) → Ch9_notebooks git:(master) ✘ node --version
v12.11.1
(venv) → Ch9_notebooks git:(master) ✘ jupyter nbextension enable --py widgetsnbextension
Enabling notebook extension jupyter-js-widgets/extension...
    - Validating: OK
(venv) → Ch9_notebooks git:(master) ✘ jupyter labextension install @jupyter-widgets/jupyterlab-manager
Building jupyterlab assets (build:prod:minimize)
(venv) → Ch9_notebooks git:(master) ✘
```

# Getting started with JupyterLab: Step 4

The screenshot shows a JupyterLab interface running in a web browser. The title bar says "Using Virtual Environments in JupyterLab". The address bar shows the URL <https://janakiev.com/blog/jupyter-virtual-envs/>. The main area has a file browser on the left showing files like "venv", "counting\_domain.ipynb", "Lorenz.ipynb" (selected), "lorenz.py", and "requirements.txt". A code editor on the right displays a notebook cell for "Lorenz.ipynb" with Python 3 selected. A modal dialog titled "Select Kernel" is open, listing options: "Start Preferred Kernel" (with "course\_venv" checked), "Use No Kernel" (with "No Kernel" selected), "Use Kernel from Preferred Session" (with "Lorenz.ipynb" selected), and "Use Kernel from Other Session". The background code cell contains imports for matplotlib and ipywidgets, followed by a plot command. Below the plot, an error message says "Error displaying widget: model not found". A note at the bottom says "For the default set of parameters, we see the trajectories swirling around two points, called attractors." The status bar at the bottom shows "Mode: Command" and "Ln 1, Col 1 Lorenz.ipynb".

# Getting started with JupyterLab: Step 5

```
Ch9_notebooks — jupyter lab — jupyter — jupyter-lab ▶ Python — 110x40
(venv) → Ch9_notebooks git:(master) ✘ ls
Lorenz.ipynb           counting_domains.ipynb requirements.txt
__pycache__             lorenz.py          venv
(venv) → Ch9_notebooks git:(master) ✘ jupyter lab
[I 14:30:00.949 LabApp] JupyterLab extension loaded from /Users/mkennedy/github/talk-python/courses/dotnet/dotnet-materials/apps/py/Ch9_notebooks/venv/lib/python3.7/site-packages/jupyterlab
[I 14:30:00.949 LabApp] JupyterLab application directory is /Users/mkennedy/github/talk-python/courses/dotnet/dotnet-materials/apps/py/Ch9_notebooks/venv/share/jupyter/lab
[I 14:30:00.950 LabApp] Serving notebooks from local directory: /Users/mkennedy/github/talk-python/courses/dotnet/dotnet-materials/apps/py/Ch9_notebooks
[I 14:30:00.950 LabApp] The Jupyter Notebook is running at:
[I 14:30:00.950 LabApp] http://localhost:8888/?token=38e97512f2b5266b23c436283008a8b17aa5238dbf615f3d
[I 14:30:00.950 LabApp] or http://127.0.0.1:8888/?token=38e97512f2b5266b23c436283008a8b17aa5238dbf615f3d
[I 14:30:00.950 LabApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[C 14:30:00.954 LabApp]

To access the notebook, open this file in a browser:
file:///Users/mkennedy/Library/Jupyter/runtime/nbserver-71573-open.html
Or copy and paste one of these URLs:
http://localhost:8888/?token=38e97512f2b5266b23c436283008a8b17aa5238dbf615f3d
or http://127.0.0.1:8888/?token=38e97512f2b5266b23c436283008a8b17aa5238dbf615f3d
[I 14:30:04.819 LabApp] Build is up to date
[I 14:30:05.471 LabApp] Kernel started: 3e45ba53-eb31-405e-add3-a974dde67a2a
[W 14:30:06.151 LabApp] Got events for closed stream None
```