

Introduction to IPython Notebook

Ward Fisher

Unidata Python Workshop

October 2014

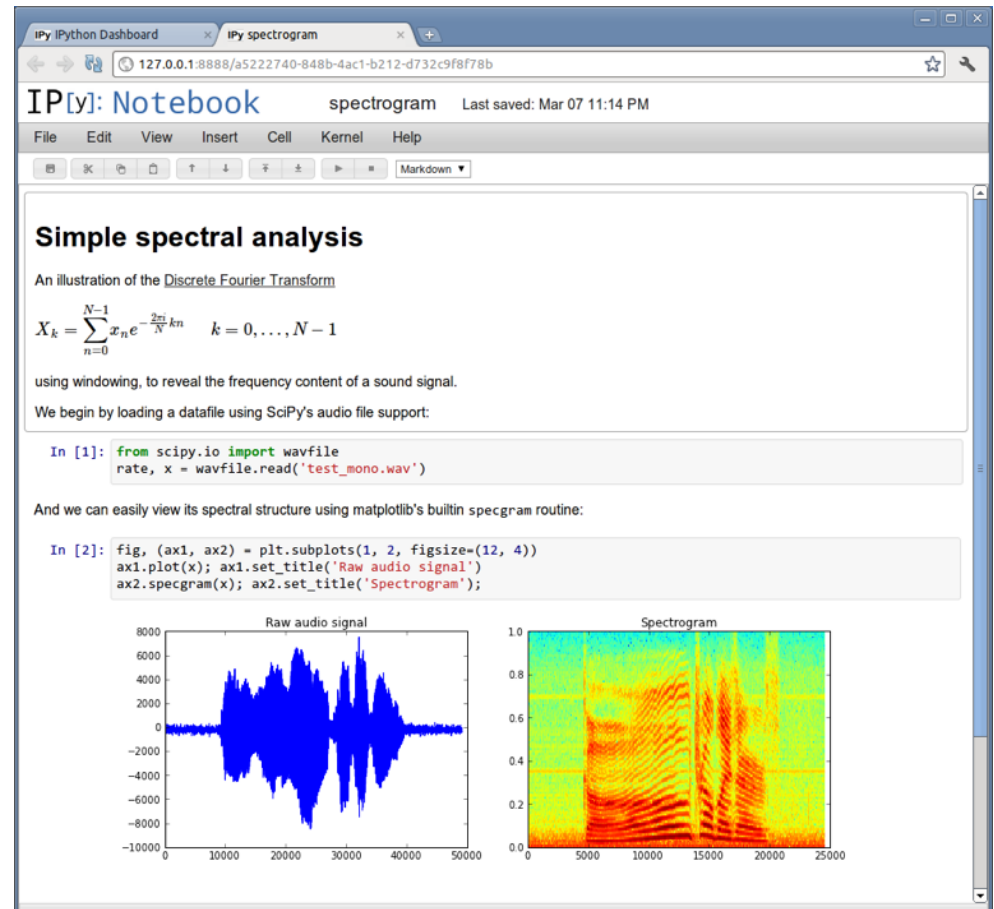
Overview

- What is IPython Notebook
- Using IPython Notebook
- IPython Notebook in the Cloud
- Examples

What is IPython Notebook?

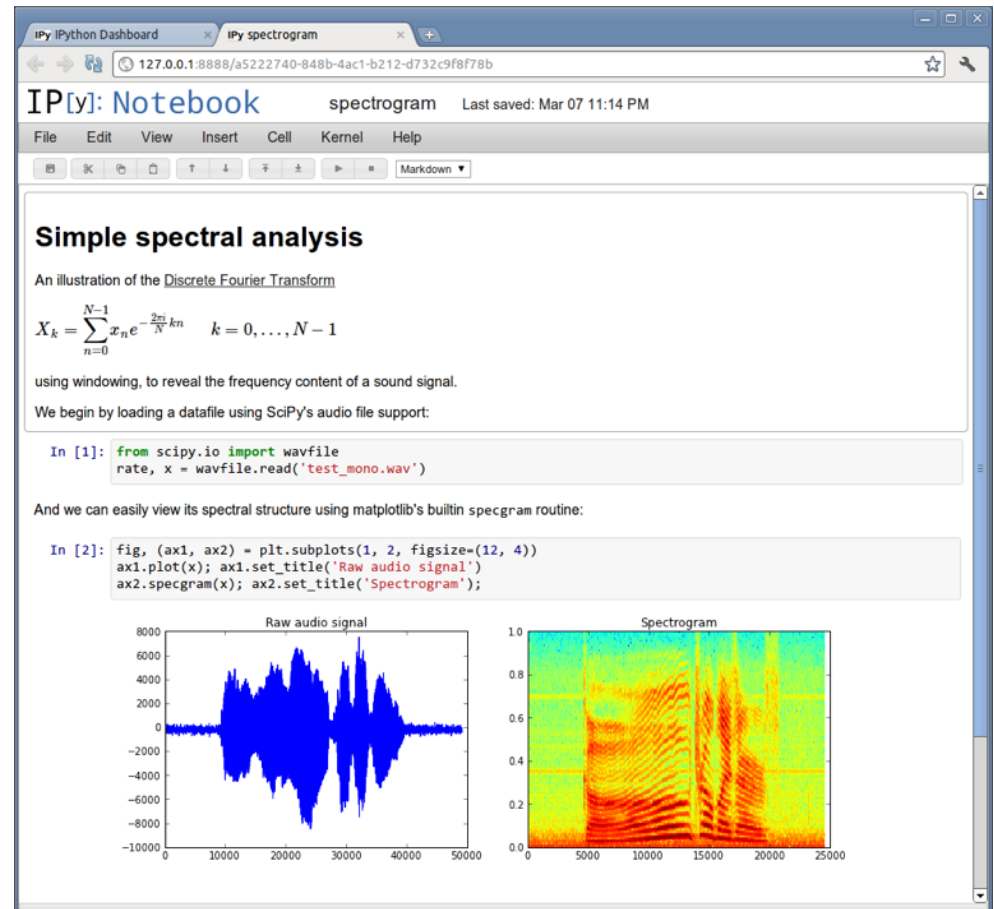
“The IPython Notebook is a web-based interactive computational environment where you can combine code execution, text, mathematics, plots and rich media into a single document”

<http://ipython.org/notebook.html>



What is IPython Notebook?

IPython
Notebooks enable
Reproducible
Science.

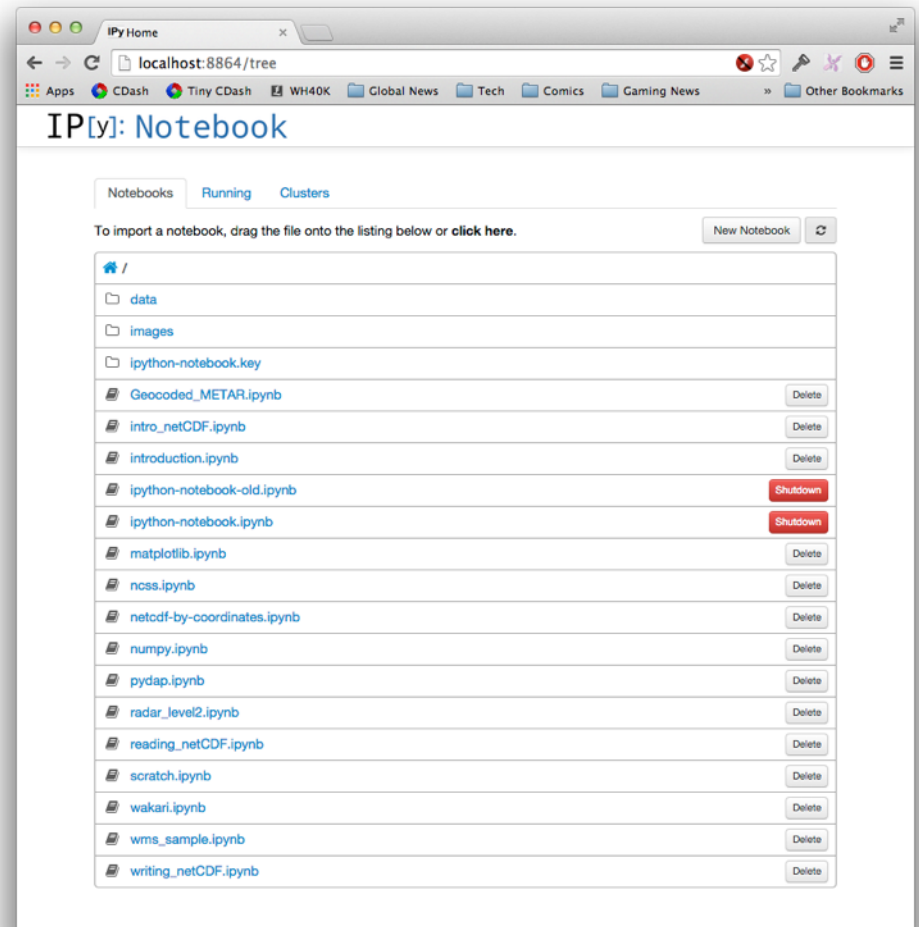


What is IPython Notebook

- IPython Notebook is comprised of two parts:
 - The IPython Notebook server
 - Individual Notebooks (.ipynb)

IPython Notebook Server

- The IPython Notebook Server acts as a dashboard for a collection of individual notebooks.



IPython Notebook Server

The screenshot shows the IPython Notebook Server interface in a web browser at `localhost:8864/tree`. The page title is "IP[y]: Notebook". It features tabs for "Notebooks", "Running", and "Clusters". A message states: "To import a notebook, drag the file onto the listing below or click here." Below this is a file listing with columns for file names and actions (Delete, Shutdown). The file listing includes:

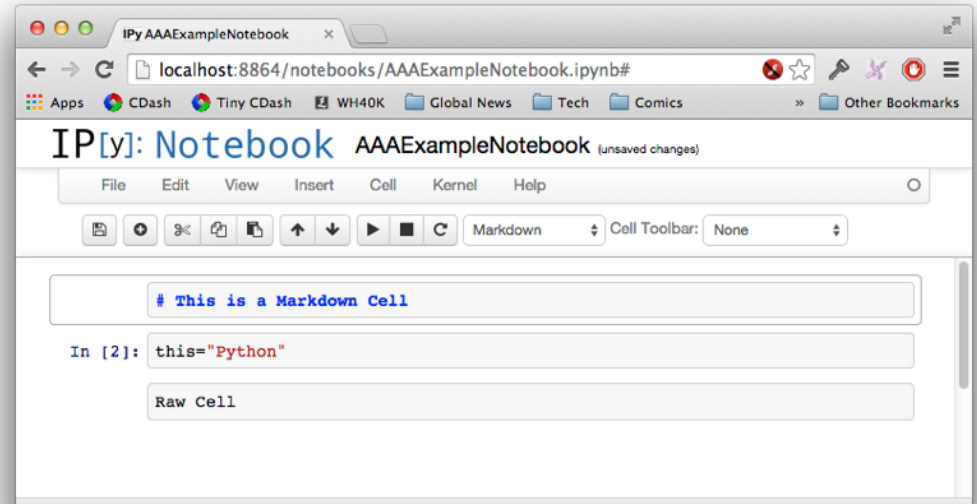
- /
- data
- images
- ipython-notebook.key
- Geocoded_METAR.ipynb
- intro_netCDF.ipynb
- introduction.ipynb
- ipython-notebook-old.ipynb
- ipython-notebook.ipynb
- matplotlib.ipynb
- ncss.ipynb
- netcdf-by-coordinates.ipynb
- numpy.ipynb
- pydap.ipynb
- radar_level2.ipynb
- reading_netCDF.ipynb
- scratch.ipynb
- wakari.ipynb
- wms_sample.ipynb
- writing_netCDF.ipynb

Three callouts highlight specific features:

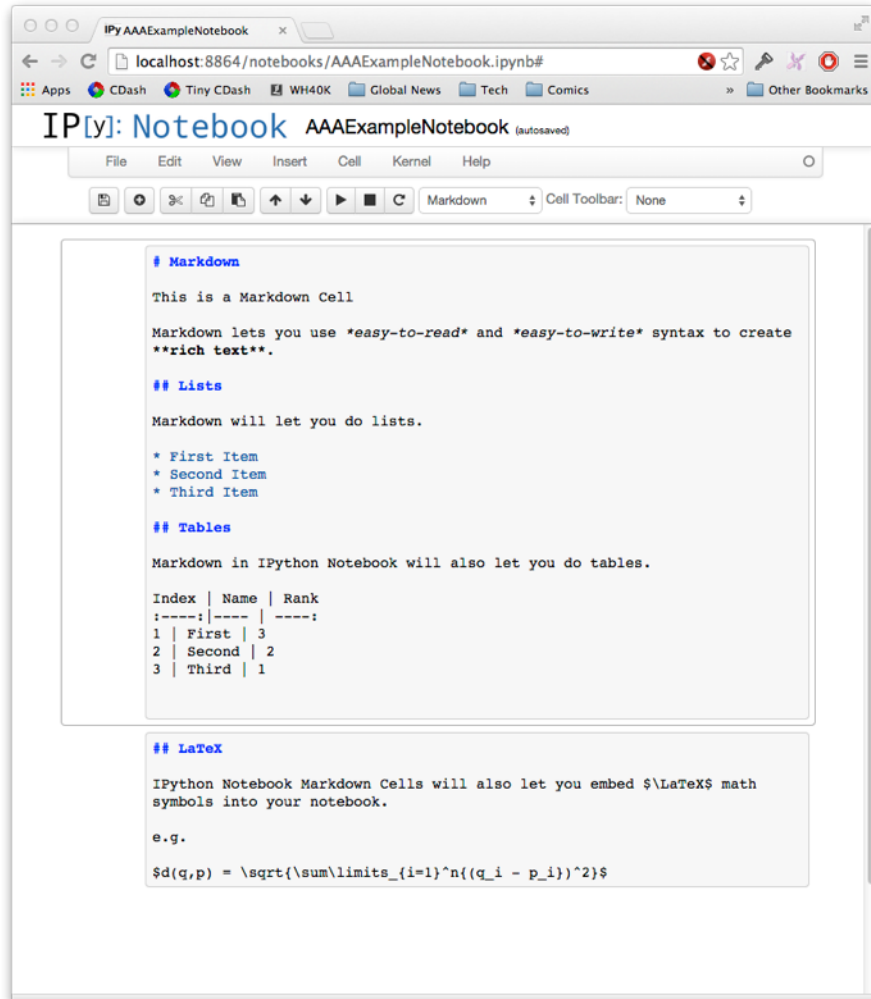
- Top Left Callout:** A circular inset showing a list of notebook files, including `intro_netCDF.ipynb`, `ipython-notebook-old.ipynb`, `ipython-notebook.ipynb`, `matplotlib.ipynb`, `ncss.ipynb`, `netcdf-by-coordinates.ipynb`, `numpy.ipynb`, and `pydap.ipynb`. A green arrow points from this callout to the file listing in the main interface.
- Top Right Callout:** A circular inset showing a "New Notebook" button and a refresh icon. A green arrow points from this callout to the "New Notebook" button in the main interface.
- Bottom Right Callout:** A circular inset showing a "Delete" button, two "Shutdown" buttons, and another "Delete" button. A green arrow points from this callout to the "Shutdown" buttons in the main interface.

IPython Notebooks

- An IPython Notebook is a collection of *cells*.
 - Markdown
 - Code
 - “Raw”



Markdown Cells



The screenshot shows a web browser window with the URL `localhost:8864/notebooks/AAExampleNotebook.ipynb#`. The notebook title is "IP[y]: Notebook AAAExampleNotebook (autosaved)". The menu bar includes File, Edit, View, Insert, Cell, Kernel, and Help. The toolbar shows icons for saving, undo, redo, and other actions. The main content area displays a Markdown cell in source code view, with the following text:

```
## Markdown

This is a Markdown Cell

Markdown lets you use *easy-to-read* and *easy-to-write* syntax to create **rich text**.

## Lists

Markdown will let you do lists.

* First Item
* Second Item
* Third Item

## Tables

Markdown in IPython Notebook will also let you do tables.

Index | Name | Rank
:----:|:----:|:----:
1 | First | 3
2 | Second | 2
3 | Third | 1

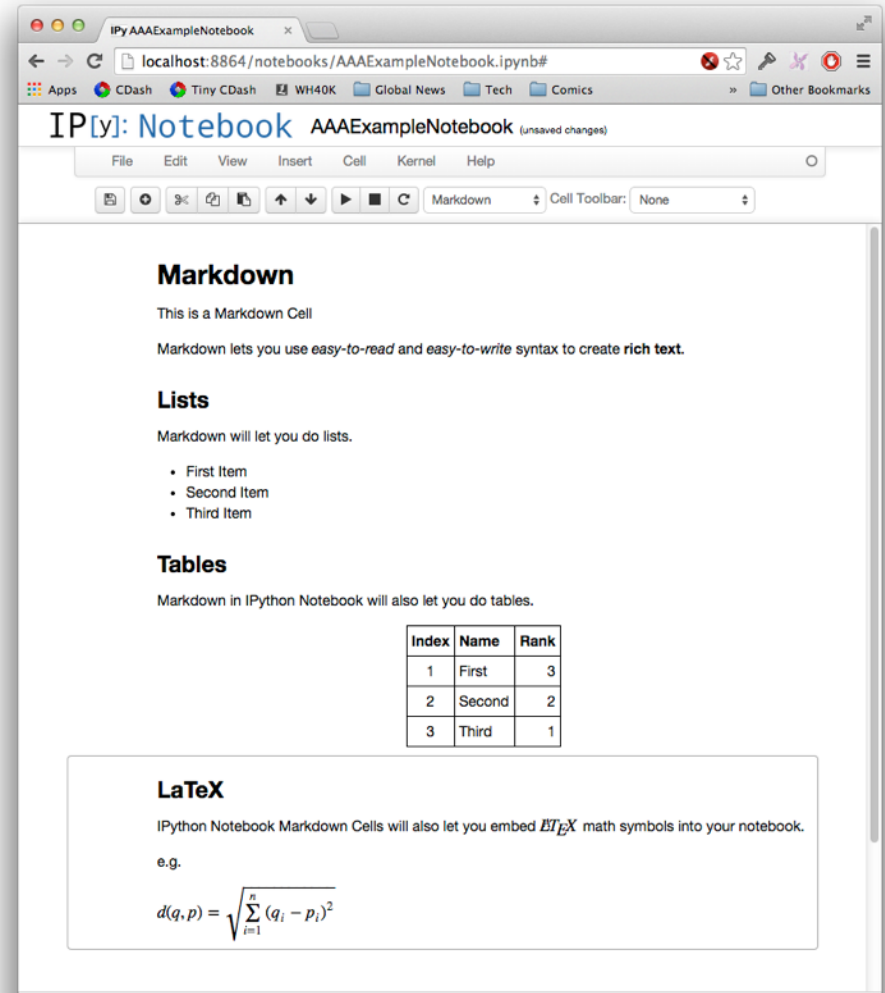
## LaTeX

IPython Notebook Markdown Cells will also let you embed  $\LaTeX$  math symbols into your notebook.

e.g.


$$d(q,p) = \sqrt{\sum \limits_{i=1}^n (q_i - p_i)^2}$$

```



The screenshot shows the same IPython Notebook interface, but the Markdown cell is now rendered. The text is formatted as follows:

Markdown

This is a Markdown Cell

Markdown lets you use *easy-to-read* and *easy-to-write* syntax to create **rich text**.

Lists

Markdown will let you do lists.

- First Item
- Second Item
- Third Item

Tables

Markdown in IPython Notebook will also let you do tables.

Index	Name	Rank
1	First	3
2	Second	2
3	Third	1

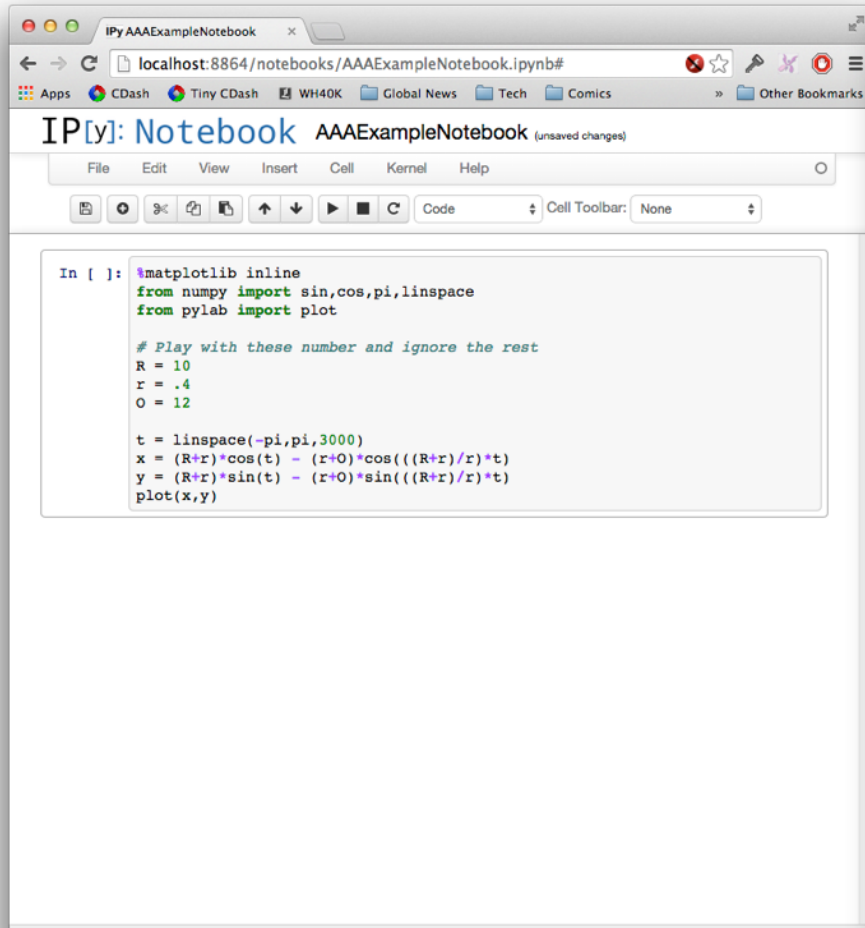
LaTeX

IPython Notebook Markdown Cells will also let you embed \LaTeX math symbols into your notebook.

e.g.

$$d(q,p) = \sqrt{\sum_{i=1}^n (q_i - p_i)^2}$$

Python Cells



IPy AAAExampleNotebook

localhost:8864/notebooks/AAAExampleNotebook.ipynb#

Apps CDash Tiny CDash WH40K Global News Tech Comics » Other Bookmarks

IP[y]: Notebook AAAExampleNotebook (unsaved changes)

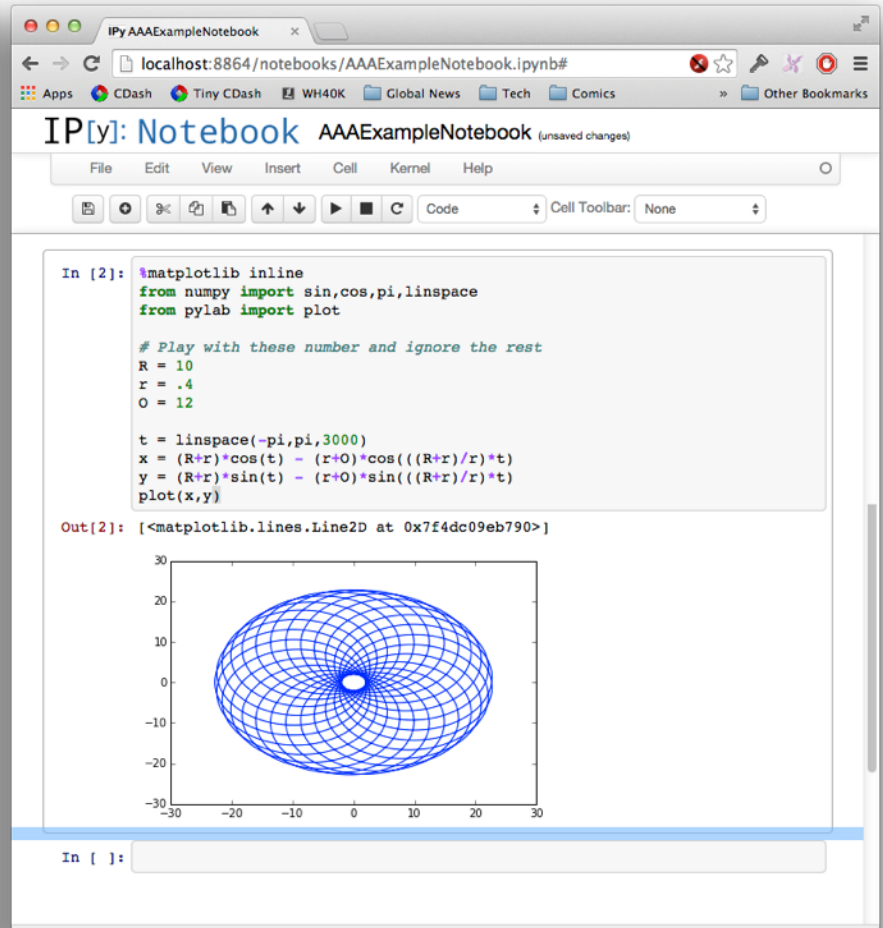
File Edit View Insert Cell Kernel Help

Code Cell Toolbar: None

```
In [ ]: %matplotlib inline
from numpy import sin,cos,pi,linspace
from pylab import plot

# Play with these number and ignore the rest
R = 10
r = .4
O = 12

t = linspace(-pi,pi,3000)
x = (R+r)*cos(t) - (r+O)*cos(((R+r)/r)*t)
y = (R+r)*sin(t) - (r+O)*sin(((R+r)/r)*t)
plot(x,y)
```



IPy AAAExampleNotebook

localhost:8864/notebooks/AAAExampleNotebook.ipynb#

Apps CDash Tiny CDash WH40K Global News Tech Comics » Other Bookmarks

IP[y]: Notebook AAAExampleNotebook (unsaved changes)

File Edit View Insert Cell Kernel Help

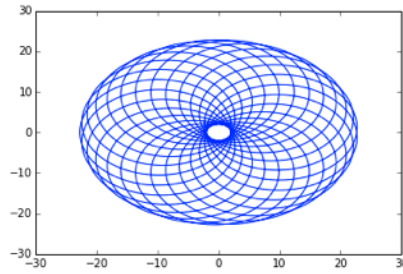
Code Cell Toolbar: None

```
In [2]: %matplotlib inline
from numpy import sin,cos,pi,linspace
from pylab import plot

# Play with these number and ignore the rest
R = 10
r = .4
O = 12

t = linspace(-pi,pi,3000)
x = (R+r)*cos(t) - (r+O)*cos(((R+r)/r)*t)
y = (R+r)*sin(t) - (r+O)*sin(((R+r)/r)*t)
plot(x,y)
```

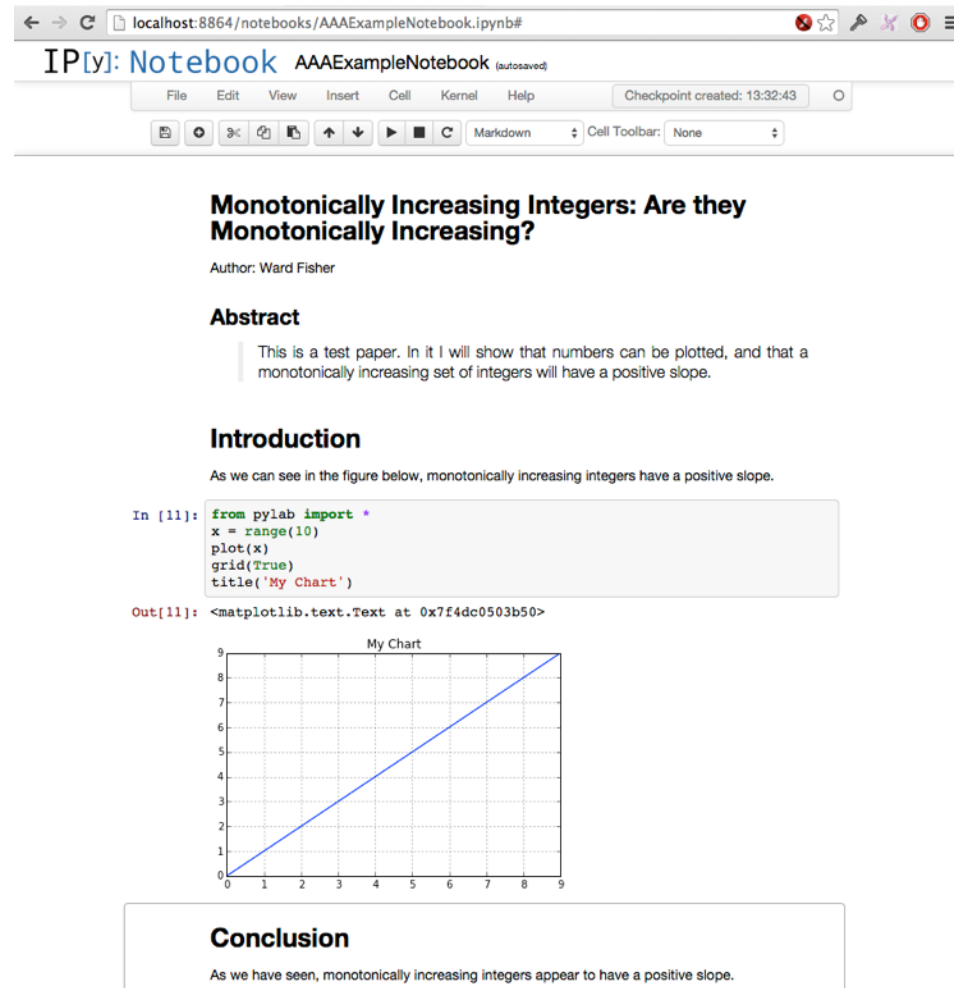
Out[2]: [<matplotlib.lines.Line2D at 0x7f4dc09eb790>]



In []:

What does this get you?

- A sharable, reproducible document with embedded experimental data analysis.



localhost:8864/notebooks/AAAExampleNotebook.ipynb#

IP[y]: Notebook AAAExampleNotebook (autosaved)

File Edit View Insert Cell Kernel Help Checkpoint created: 13:32:43

Monotonically Increasing Integers: Are they Monotonically Increasing?

Author: Ward Fisher

Abstract

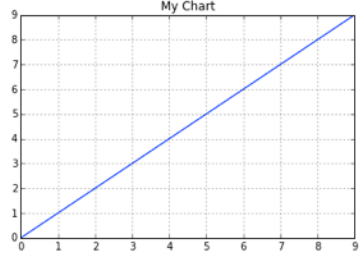
This is a test paper. In it I will show that numbers can be plotted, and that a monotonically increasing set of integers will have a positive slope.

Introduction

As we can see in the figure below, monotonically increasing integers have a positive slope.

```
In [11]: from pylab import *
x = range(10)
plot(x)
grid(True)
title('My Chart')
```

Out[11]: <matplotlib.text.Text at 0x7f4dc0503b50>



Conclusion

As we have seen, monotonically increasing integers appear to have a positive slope.

Installing IPython Notebook

- The easiest way to install IPython notebook is with a package manager like “Conda”
 - Maintained by Continuum Analytics
 - <http://continuum.io/downloads>

Installing IPython Notebook

- Once Anaconda is installed, you can use the 'conda' command to install ipython notebook (and other packages).

```
$ conda install ipython ipython-notebook
```

Launching IPython Notebook

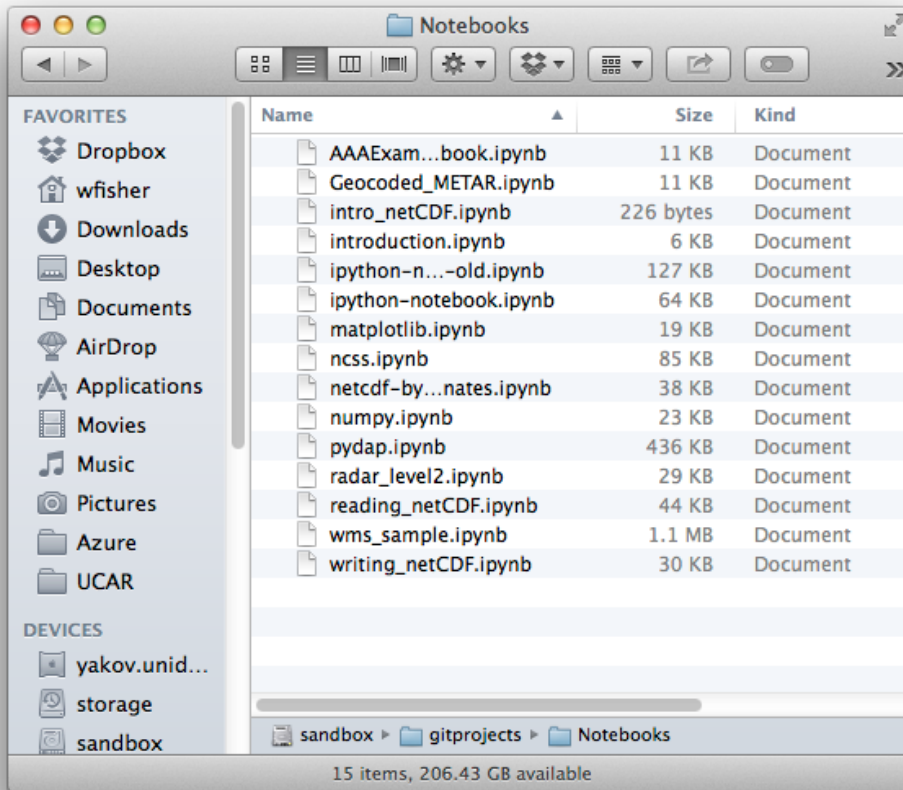
- IPython Notebook is launched via the command line.

```
$ ipython notebook
```

- There are a number of command line options for advanced usage.

Running IPython Notebook Server

- Notebooks are arranged in a directory.
- You will launch IPython Notebook from the root of this directory structure.



Running IPython Notebook Server

