

Introduction to CoCalc

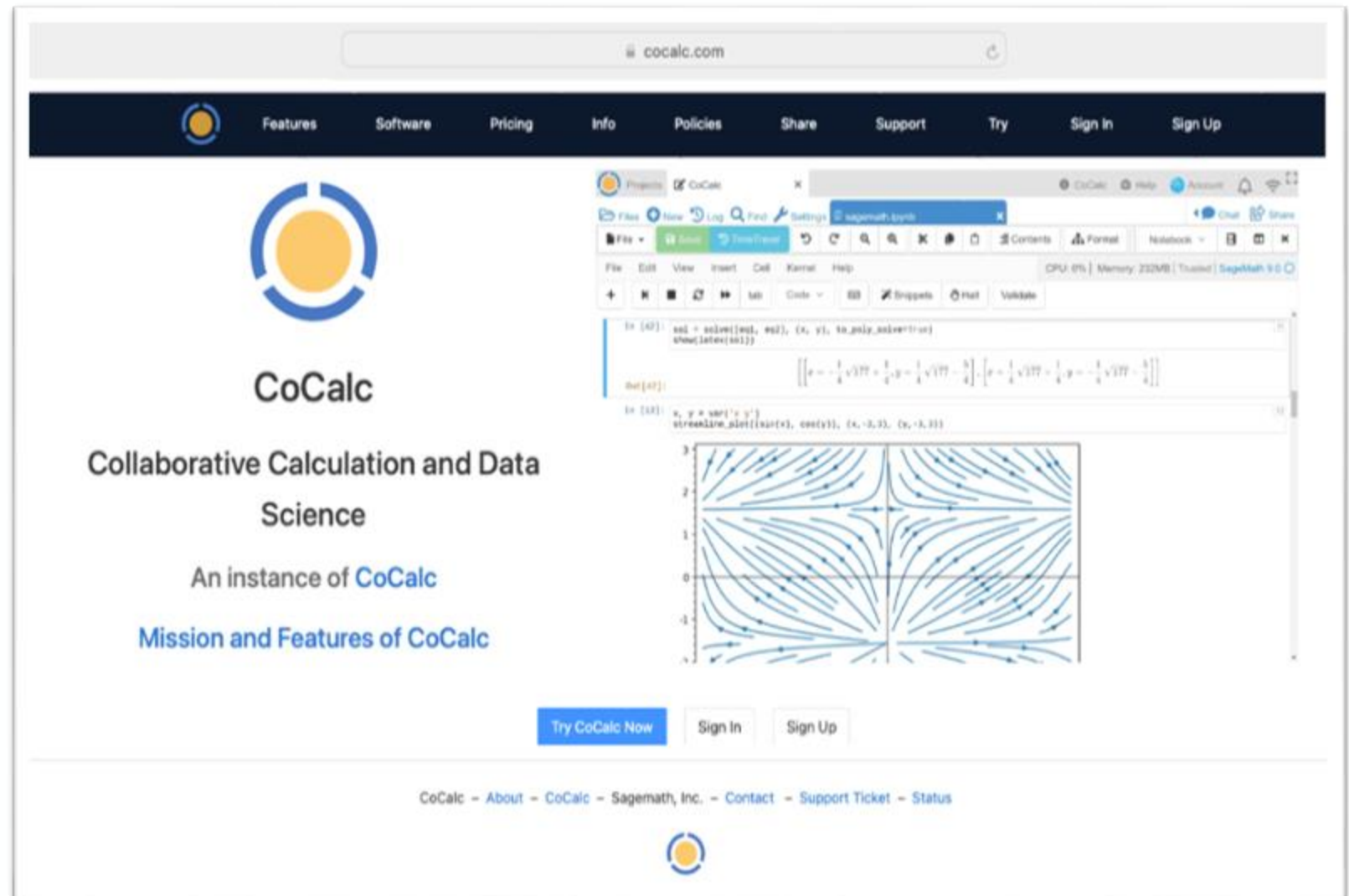
And Jupyter notebooks

Carl Gwilliam
(C.Gwilliam@liverpool.ac.uk)



What is CoCalc?

- CoCalc is a virtual online workspace for collaborative learning and research: <https://cocalc.com>
- It provides online resources
 - CPU, memory, storage
 - Via a university licence
- Which enables us to
 - Share documents & code
 - Set & collect assignments
 - Work on code together
- You will be using it in
 - Intro to Computational Physics (PHYS105)
 - Practical Physics (PHYS106)
 - Other courses in later years



Signing up and logging in

- The first thing you need to do is to sign up to the CoCalc platform and sign up
 - In a way that allows you to use the university license
- You should have received an invite email for PHYS105
 - Click on link or go directly to the CoCalc webpage
 - Sign up with your university email address and a password of your choice
 - Important: use **exactly** the address it was sent to as CoCalc doesn't know about uni email aliases
- If you have not done this, please do so now
 - Let me know if you have not received an invite
 - Or if you have issues signing up with it
- Once signed up, go to Projects & navigate to
 - Name - PHYS105 Introduction to Computational Physics
PHYS105_2024
 - PHYS105 Introduction to Computational Physics
 - ComputerClassesStudent
 - Phys105-Welcome



What are Jupyter notebooks?

- [Jupyter](#) is an interactive development environment for data analysis and software code
 - Used widely across both academia and industry
- It reads files known as Jupyter notebooks (.ipynb) which bring together in a shareable way:
 - Formatted documentation
 - Interactive code development
 - The resulting (graphical) output
- Notebooks are composed of a series of cells
 - Building blocks which can be edited and run
- Cells may contain either
 - [Python](#) computer code
 - [Markdown](#) formatted text
- Can be saved to PDF to submit assignments
 - File → Save and Export as PDF → PDF (.pdf)

Double-click on a cell to edit

```
Markdown and LaTeX formulas. Use @name to mention people. Attach images by drag & drop, select or paste. Text Markdown
1 # Introduction to Jupyter
2
3 This is a very basic example [Jupyter](https://jupyter.org) notebook
```

```
Markdown and LaTeX formulas. Use @name to mention people. Attach images by drag & drop, select or paste. Text Markdown
1 ## Text cells
2
3 It can contain formatted text, equations, tables, figures etc using [Markdown]
  (https://docs.github.com/en/get-started/writing-on-github/getting-started-with-writing-
  and-formatting-on-github/basic-writing-and-formatting-syntax) syntax
4
```

```
Markdown and LaTeX formulas. Use @name to mention people. Attach images by drag & drop, select or paste. Text Markdown
1 ## Code cells
2
3 Along with cells containing executable code in the [python language]
  (https://docs.python.org/3/tutorial/)
```

```
1 year = "first"
2 print("Welcome to the", year, "year")
```

```
1 answer = 13+29
2 print (answer)
```

What are Jupyter notebooks?

- [Jupyter](#) is an interactive development environment for data analysis and software code
 - Used widely across both academia and industry
- It reads files known as Jupyter notebooks (.ipynb) which bring together in a shareable way
 - Formatted documentation
 - Interactive code development
 - The resulting (graphical) output
- Notebooks are composed of a series of cells
 - Building blocks which can be edited and run
- Cells may contain either
 - [Python](#) computer code
 - [Markdown](#) formatted text
- Can be saved to PDF to submit assignments
 - File → Save and Export as ... → PDF (.pdf) ...

Press run (▶|) or type `shift+enter` to execute

Introduction to Jupyter

This is a very basic example [Jupyter](#) notebook

Text cells

It can contain **formatted** text, equations, tables, figures etc using [Markdown](#) syntax

Code cells

Along with cells containing executable code in the [python language](#)

```
In [3]: 1 year = "first"
        2 print("Welcome to the", year, "year")
```

Out[3]: Welcome to the first year

```
In [4]: 1 answer = 13+29
        2 print (answer)
```

Out[4]: 42

Try this now with [Example.ipynb](#) in your CoCalc folder

What are Jupyter notebooks?

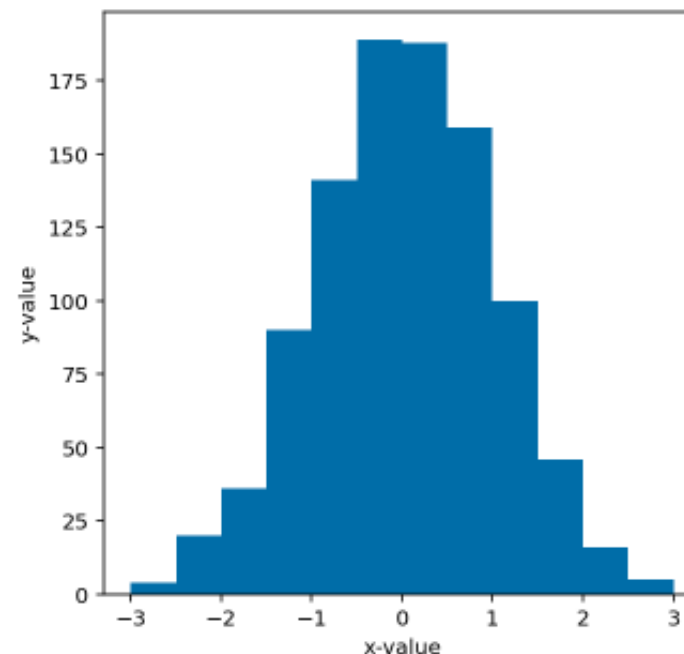
- Allow powerful data analysis and direct visualisation of outputs inline e.g

Plot some data

```
In [8]: 1 # Create data using numpy
        2
        3 import numpy as np
        4 data = np.random.normal(size=1000)
```

```
In [9]: 1 # Plot data using matplotlib
        2
        3 import matplotlib.pyplot as plt
        4
        5 plt.figure()
        6 plt.xlabel("x-value")
        7 plt.ylabel("y-value")
        8 plt.hist(data, bins=12, range = (-3, 3))
        9 plt.show()
```

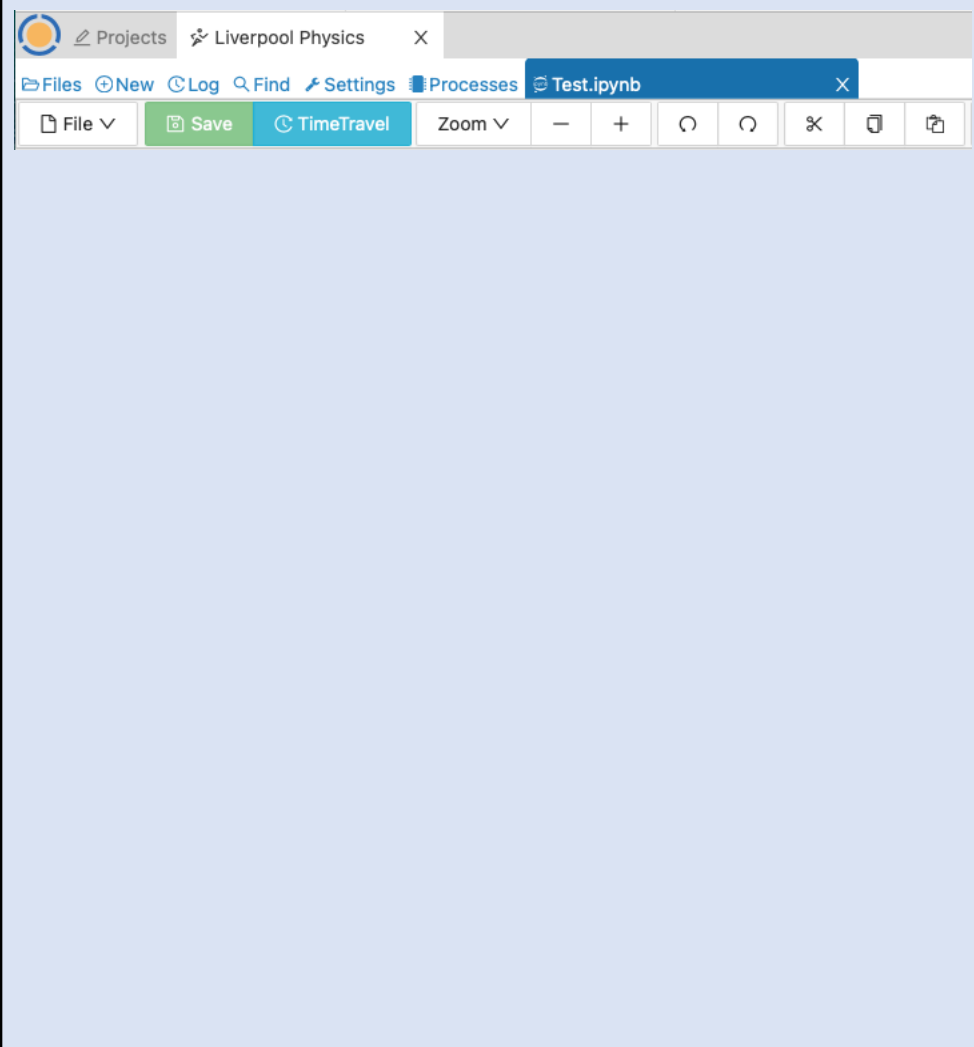
Out[10]:



- You will learn all about this, and the tools to do it, in Intro to Computational Physics (PHYS105)
 - You are not expected to know them yet and many terms will be new at the moment, so don't worry!

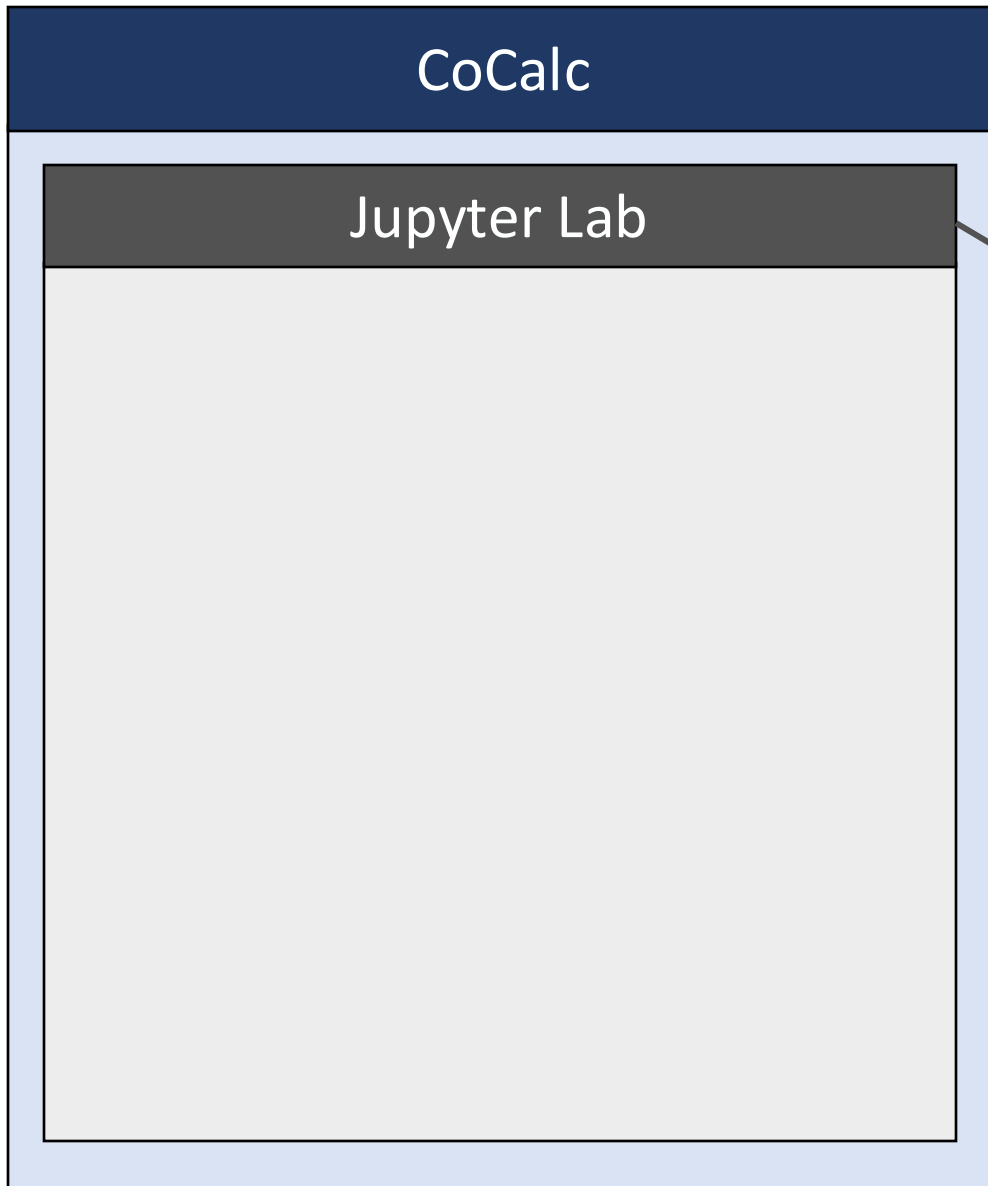
Summary

CoCalc



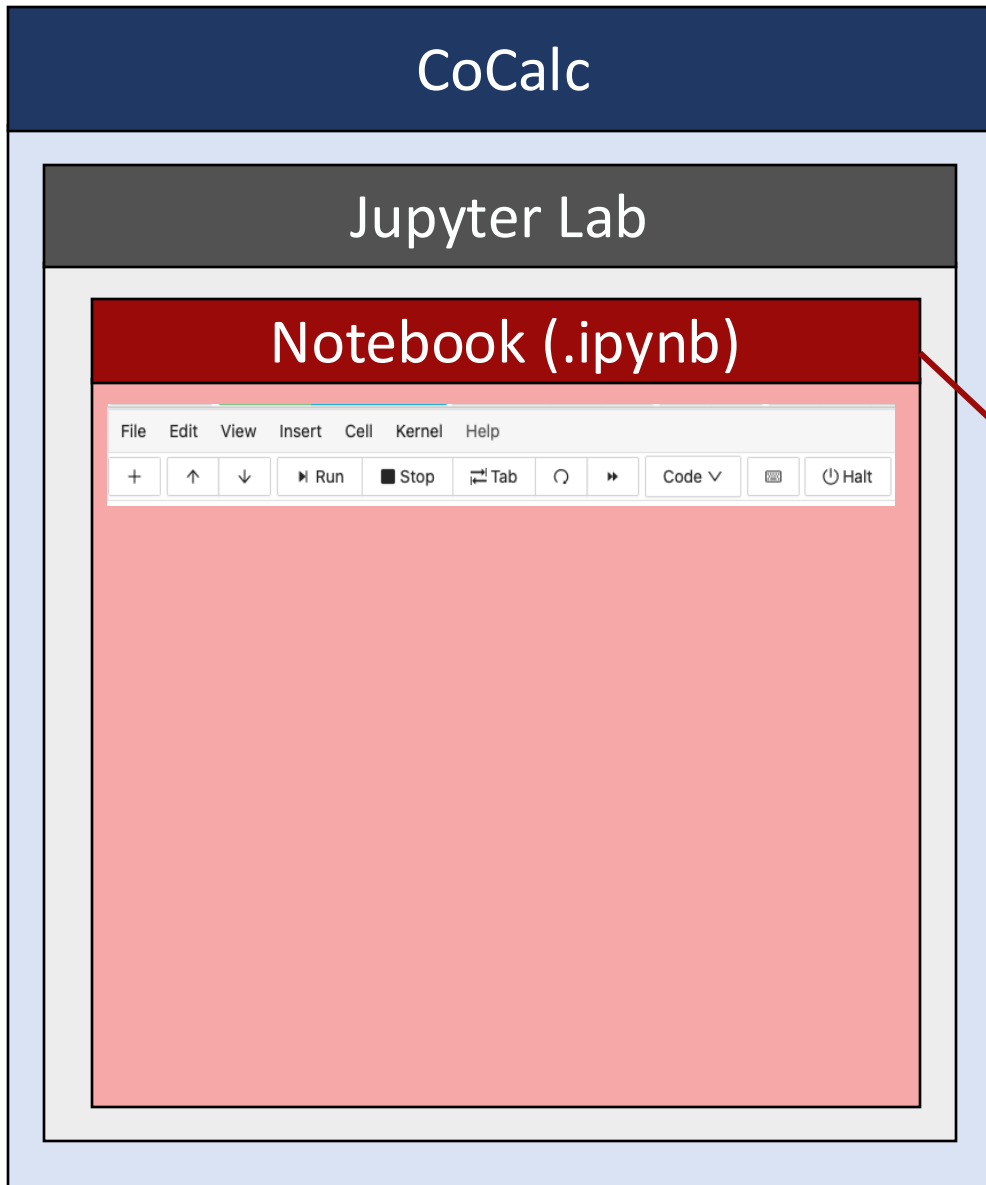
- Collaborative online coding platform (i.e. website)
 - Allows lecturers and students to work together
 - All files are stored, saved and synchronised here

Summary



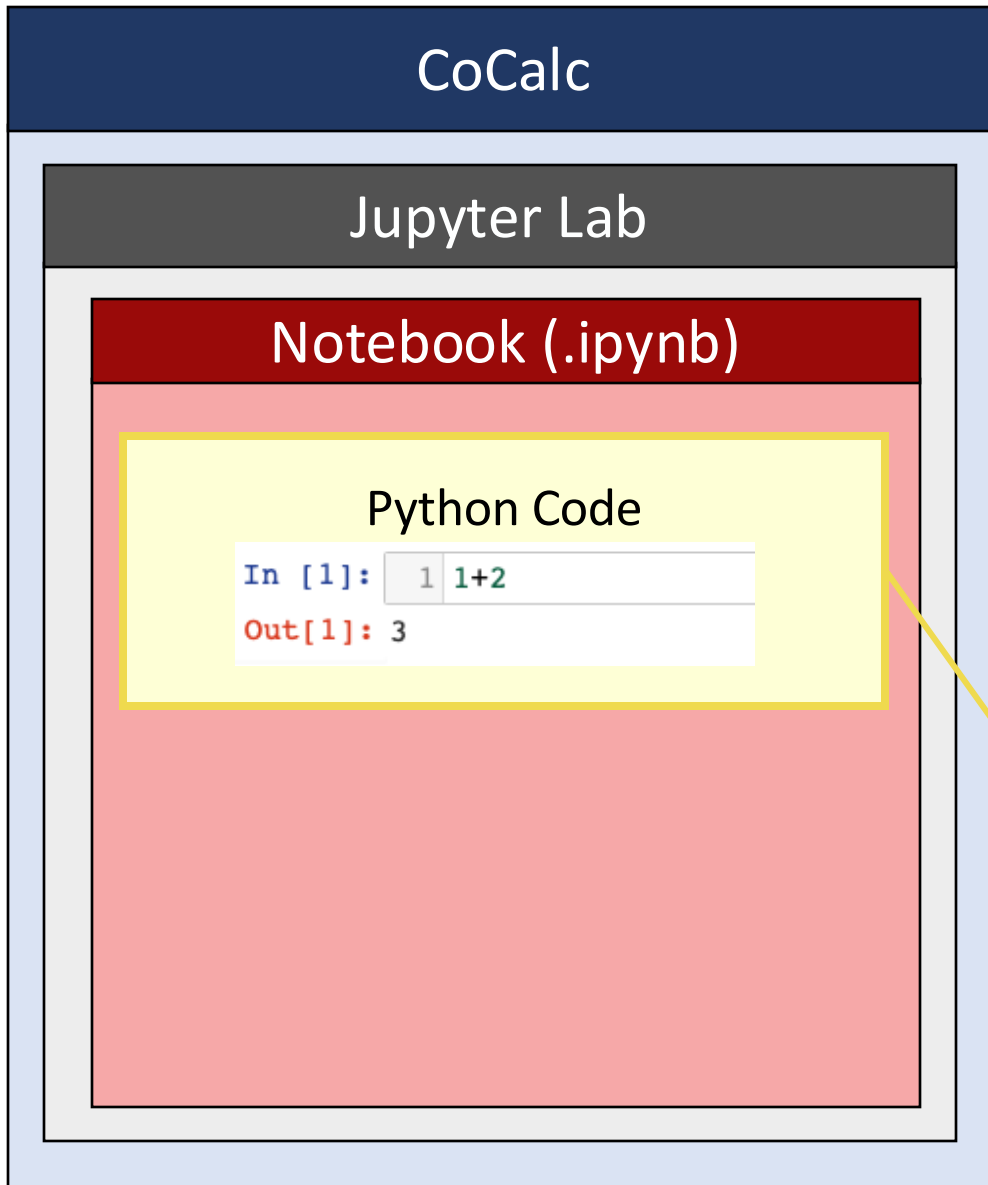
- Collaborative online coding platform (i.e. website)
 - Allows lecturers and students to work together
 - All files are stored, saved and synchronised here
- Runs program that reads .ipynb notebook files
 - Can also be run directly on your local machine

Summary



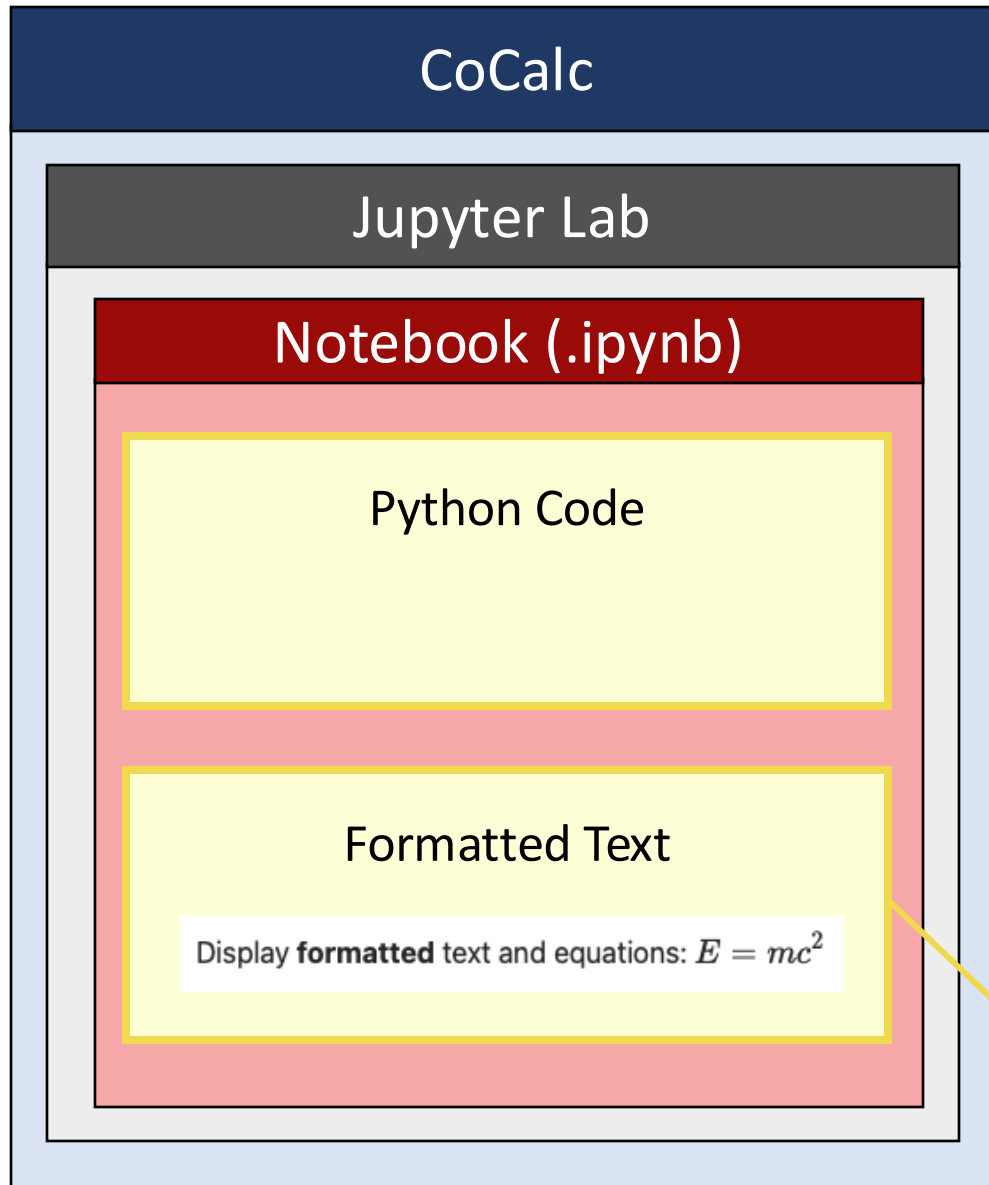
- Collaborative online coding platform (i.e. website)
 - Allows lecturers and students to work together
 - All files are stored, saved and synchronised here
- Runs program that reads .ipynb notebook files
 - Can also be run directly on your local machine
- A file type containing instructions for displaying markdown and code cells, interpreted by Jupyter Lab
 - Python cells are executed by the python interpreter
 - Text cells are rendered by markdown interpreter
 - These are separate entities brought together in Jupyter

Summary



- Collaborative online coding platform (i.e. website)
 - Allows lecturers and students to work together
 - All files are stored, saved and synchronised here
- Runs program that reads .ipynb notebook files
 - Can also be run directly on your local machine
- A file type containing instructions for displaying markdown and code cells, interpreted by Jupyter Lab
 - Python cells are executed by the python interpreter
 - Text cells are rendered by markdown interpreter
 - These are separate entities brought together in Jupyter
- The programming language we will be using
 - Performs calculations and data processing
 - PHYS105 will teach you this from scratch

Summary



- Collaborative online coding platform (i.e. website)
 - Allows lecturers and students to work together
 - All files are stored, saved and synchronised here
- Runs program that reads .ipynb notebook files
 - Can also be run directly on your local machine
- A file type containing instructions for displaying markdown and code cells, interpreted by Jupyter Lab
 - Python cells are executed by the python interpreter
 - Text cells are rendered by markdown interpreter
 - These are separate entities brought together in Jupyter
- The programming language we will be using
 - Performs calculations and data processing
 - PHYS105 will teach you this from scratch
- Formatted text entered via Markdown syntax
 - CoCalc has a graphical WYSIWIG editor interfaced to this