

# Introduction to Computational Physics (Phys105)

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## What will we do this year?

- Using CoCalc and Jupyter Notebooks.
- Installing Python on your own computer.
- Fitting laboratory data.
- Python data and control structures.
- Matplotlib and Numpy.
- Random numbers and Monte Carlo methods.
- Numerical solution of equations.
- Image analysis.
- Introduction to computer algebra.

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## Who will we do it with?

### Staff

- Tim  
Greenshaw



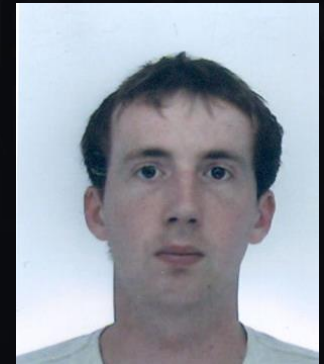
- Carl  
Gwilliam



- Jan  
Kretzschmar



- Joe  
Price



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Who will we do it with?

## Postgraduate demonstrators

- Daniel Bromley



- Selina Dhinsey



- Barney Ellis



- Ondrej Sedlacek



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## And how will we do it?

- Online lectures.
  - We will use Teams – make sure you have this on your computer!
- Computer classes.
  - These will be face-to-face, in “bubbles” of about 20.
  - Demonstrators will be on hand to help you with any difficulties you have working through the course’s Jupyter Notebooks.
  - We will use CoCalc, which means we can move completely online if necessary.

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## Computer classes

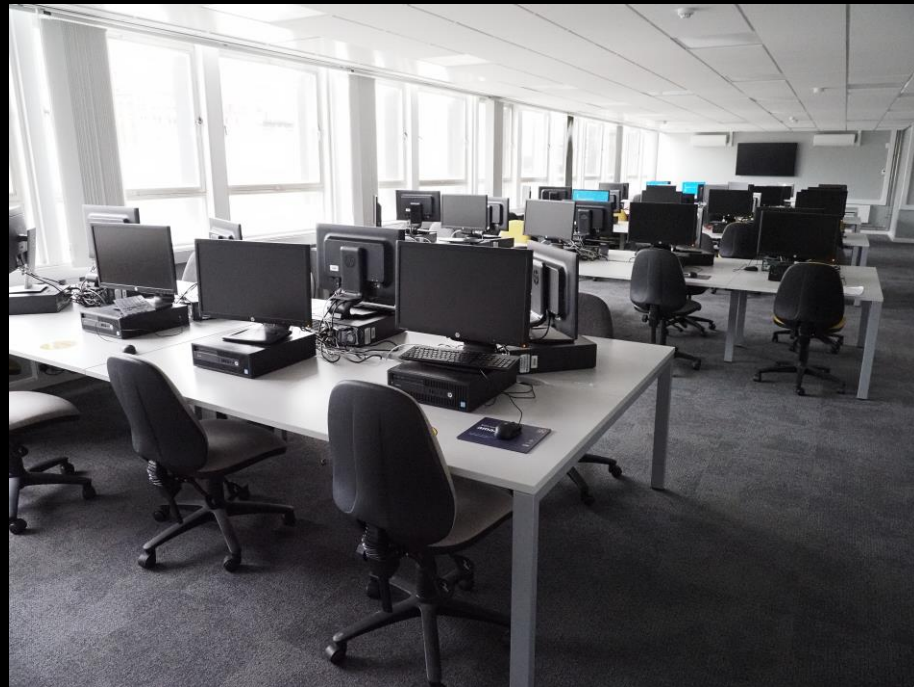
- Will be held in the MOTC PC centre.
- This is in room 101, on the first floor of Maths.
- Building 206 on the Campus Map.



## Computer classes

- MOTC

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# Jupyter Notebooks

Phys105-Week01-Student

January 31, 2020

## 1 Introduction to Computational Physics - Week 1

### 1.1 Table of contents week 1

Introduction to Computational Physics - Week 1: Section 1

-Table of contents week 1: Section 1.1

-Introduction to week 1: Section 1.2

-Installing Python and Jupyter software: Section 1.3

-Jupyter Notebooks: Section 1.4

-Week 1 exercise 1: Section 1.4.1

-Markdown cells: Section 1.5

-Entering text and tables: Section 1.5.1

-Including links: Section 1.5.2

-Figures: Section 1.5.3

-Entering formulae: Section 1.5.4

-Week 1 exercise 2: Section 1.5.5

-Code cells: Section 1.6

-An imaginary experiment: Section 1.6.1

-Fitting a straight line to data: Section 1.6.2

-Week 1 exercise 3: Section 1.6.3

-Results: Section 1.6.4

-Week 1 exercise 4: Section 1.6.5

-Week 1 exercise 5: Section 1.6.6

### 1.2 Introduction to week 1

The aim of the Introduction to Computational Physics (Phys105) module is to provide a practical introduction to programming in Python for Physics students and students on related courses. It takes a "bottom-up" approach: from day one we use examples to develop an understanding of how Python programs can be used to tackle physics problems, rather than first learning a lot of general principles and then trying to apply them. There are two reasons for this. Firstly, you will be using Python in your practical and some other modules soon, so need to be in a position to do some things quite quickly. Secondly, most people learn more effectively by actually doing things than by just hearing how they can be done.

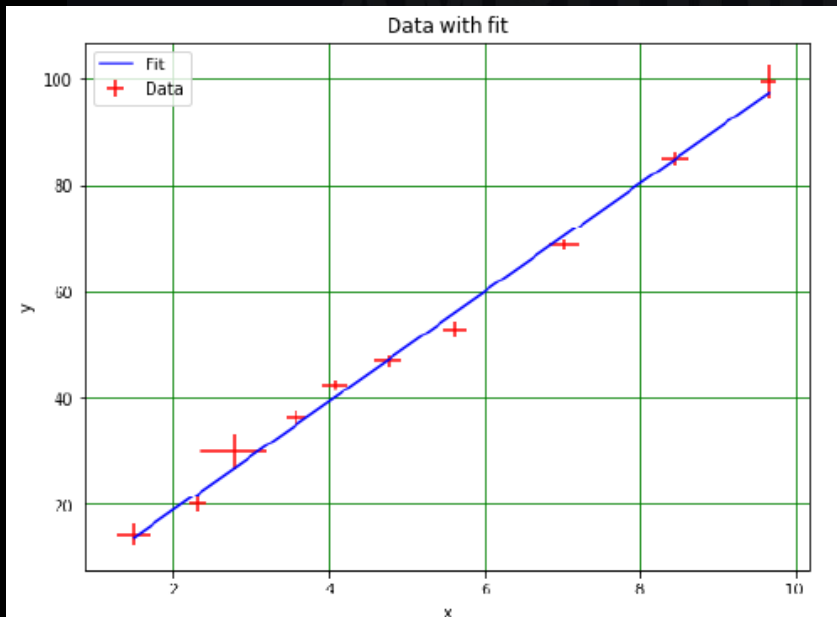
$$\int_0^{\pi} \sin x dx = (-\cos x)_0^{\pi} \quad (1)$$

$$= -(\cos(\pi) - \cos(0)) \quad (2)$$

$$= -(-1 - 1) \quad (3)$$

$$= 2. \quad (4)$$

```
#
def fitLineDiff(p, x):
    """
    Differential of straight line
    """
    df = p[1]
    return df
#
def fitChi(p, x, y, xerr, yerr):
    """
    Cost function
    """
    e = (y - fitLine(p, x))/(np.sqrt(yerr**2 + fitLineDiff(p, x)**2*xerr**2))
    return e
```





## CoCalc

- The Physics Department has bought the CoCalc package to make sure teaching is as interactive as possible, whatever Covid throws at us.
- Allows us to [run Jupyter Notebooks online](#).
- Demonstrators can edit and run your code with you “live”, while talking/chatting using Teams.
- We will spend the first week learning how to sign in to CoCalc and use this new tool!
- Looking forward to working with to make Phys105 a success!

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