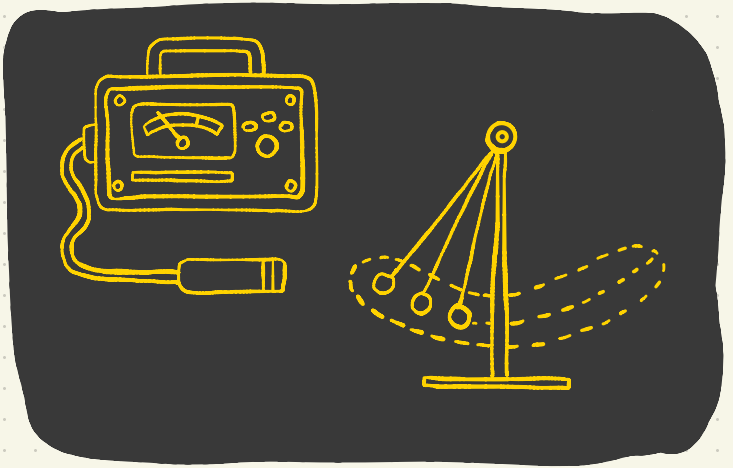
Newcastle University

Portfolio Feedback Session

PHY1030

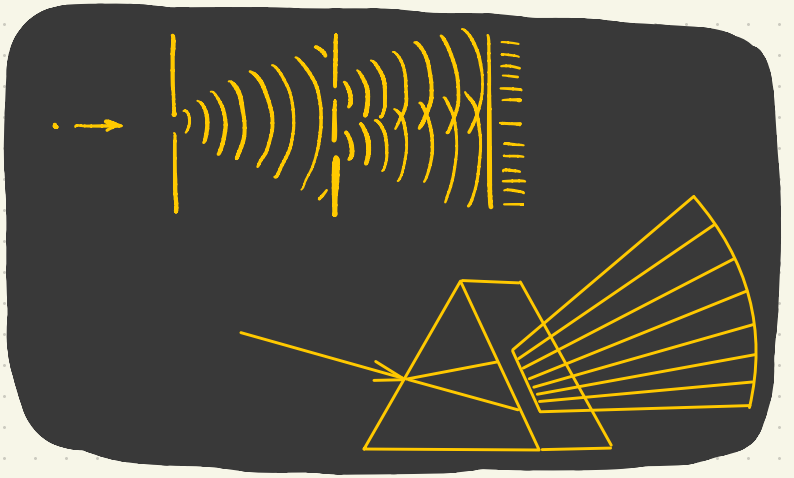


Outline

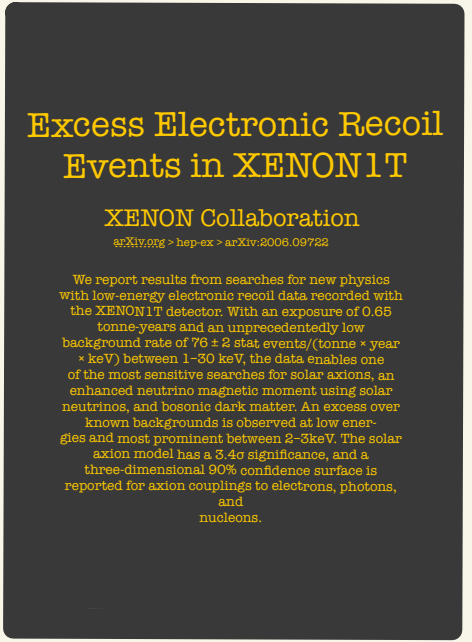
- introduction
- go over common mistakes
- what is a good report
- tips & tricks
- establish an algorithm
- learn from mistakes
- take home message

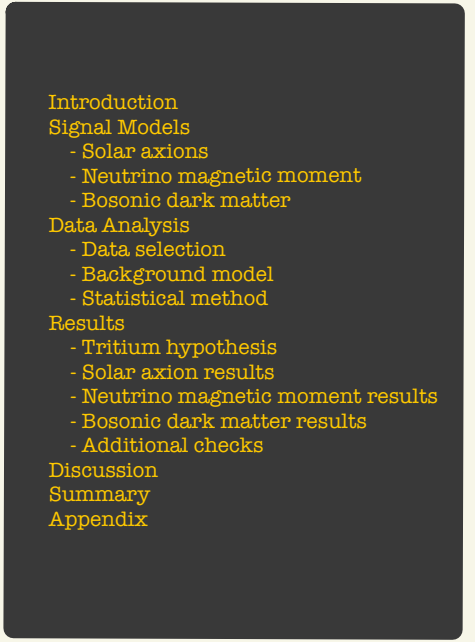
before we dive in, let's reflect

- why are we doing 100 years old experiments?
- what is the point of all the steps?
- what is the purpose?
- .....



Many goals:
- see physics at work
- experience theory+experiment
- prepare for research
- and much, much more

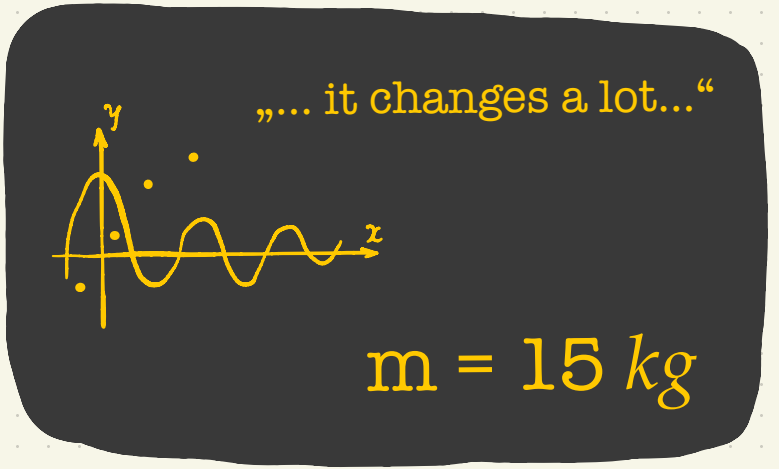




- modern research - focus on the sections
- compare to your report, find a similar structure
- learn to walk before you run (cheesy but true)
- “protoscientists”

Common mistakes

- units
- formatting & standards
- data representation (tables & plots)
- analysis & discussion
- conclusions / results



Common mistake number one: units

- in my experiment: 99 % of reports lack units
- physics experiments: measure (stuff)
- units are crucial & fundamental
- important IRL as well

→ Price of something: 3000 RSD OR GBP?

→ Retiling your kitchen backsplash?
Need units of area to get an estimate!

Common mistake number one: units

this can be a lot of things

$$T = 2.72548 \pm 0.00057$$

$$T = 2.72548 \pm 0.00057\ \mathrm{K}$$

this is clearly a temperature
in units of kelvin

Common mistakes: standards and formatting

- standard: quantities italicized & units upright
- operators not italicized
- equation formatting
- exponents
- .....

1.6*10^-19 C ✗

1.6×10^{-19} C ✓

m	m
mass	meter
A	A
area	ampere

✗	✓
$cos(2\pi)$	$\cos(2\pi)$
dt	dt

Common mistakes: data analysis

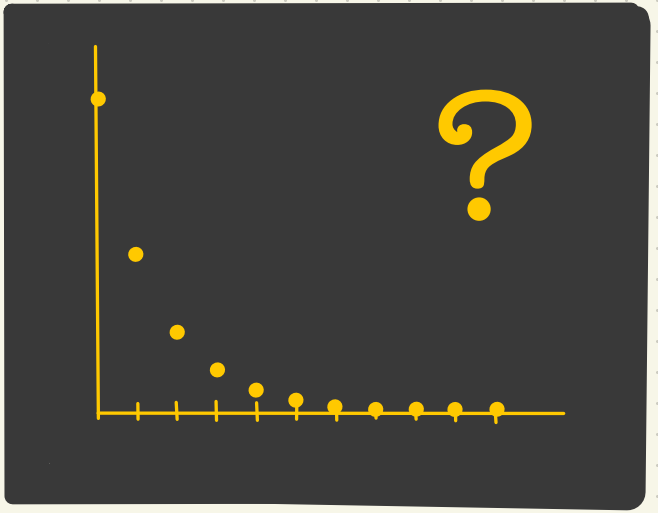
- data in tables (quantities and units)
- labeling, captioning is important
- table contains your measurements!

f E14	U
8.21 E14	-1.85
7.40 E14	-1.49
6.88 E14	-1.29

spot the mistakes

Common mistakes: plots
(data analysis)

Basics:
- labels
- units
- tick labels
- caption and/or title



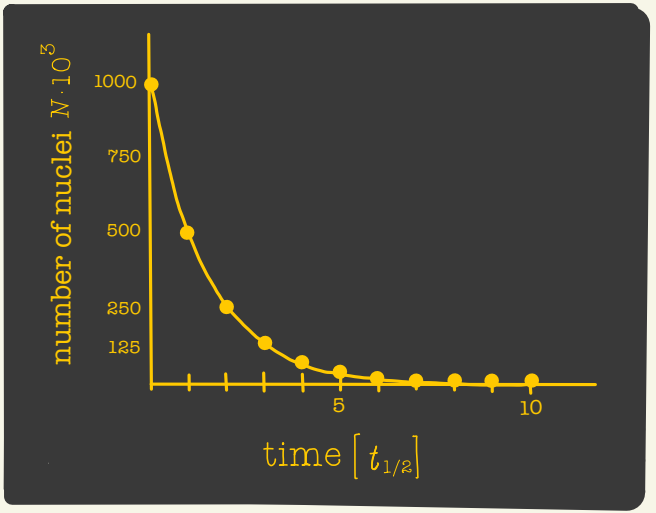
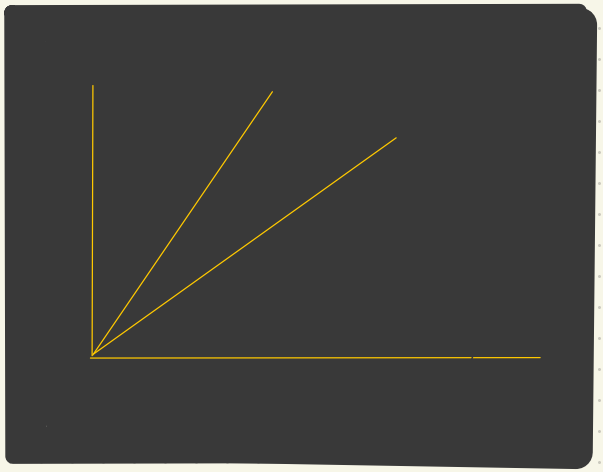
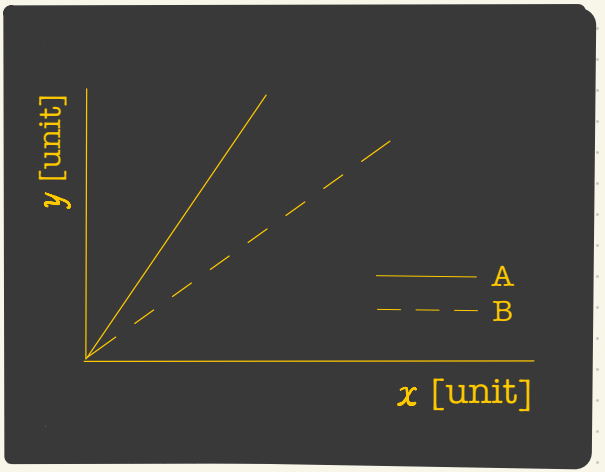


Fig. 1.2: The number of nuclei as a function of time. Radioactive decay reduces the number of nuclei over time. In one half-life, the number of nuclei decreases to half of its original value. The radioactive decay is exponential.

Common mistakes: plots

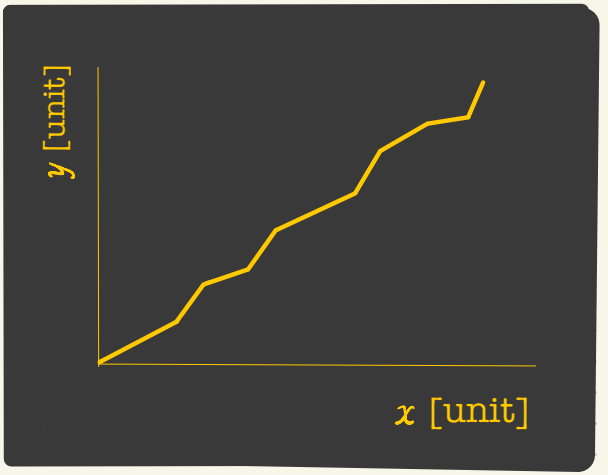
- multiple functions
- colors, line style
- legend

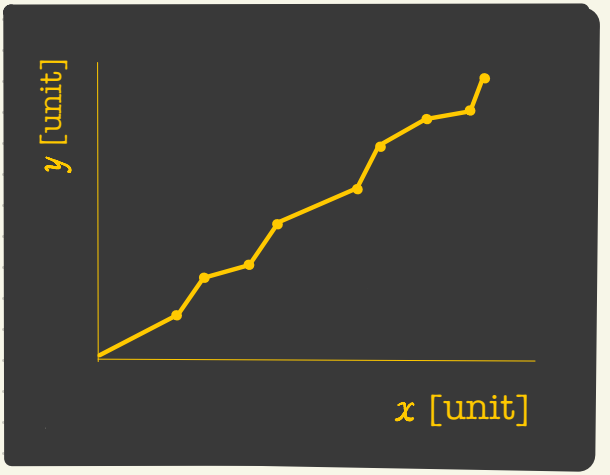




Common mistakes: plots

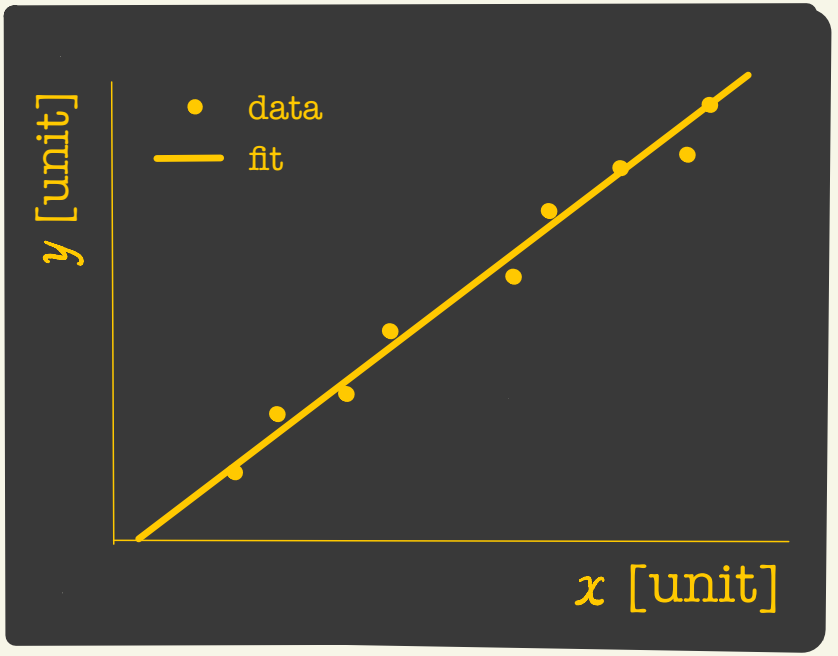
Python example
- data, $y = f(x)$
- first step is to just plot
- use plt.plot(x,y)
- however, that is only plotting data
- need a fit
- fit gives us the functional dependency





Common mistakes: plots

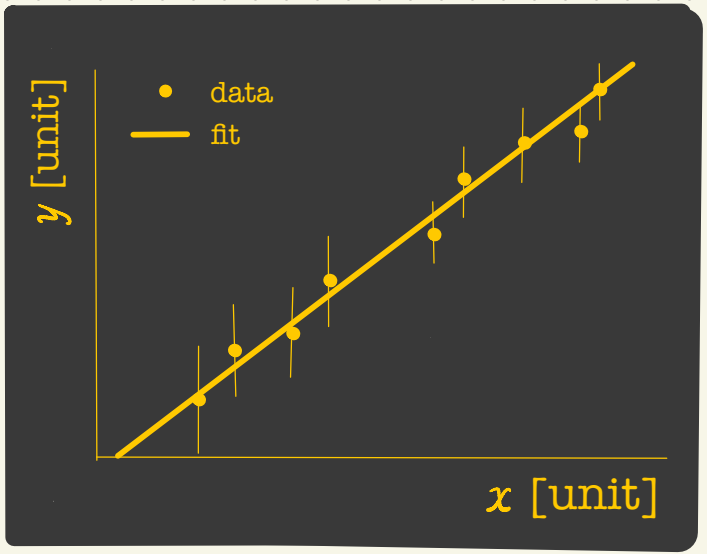
Good practice:
- plot the data
- inspect and decide on a fit
- plot data as scatter
- plt.scatter(x,y)
- if linear, fit a linear function
- several ways (numpy, scipy)



- only this way can obtain a slope and intercept
- functional dependency
- physical law

Common mistakes: plots

- include error bars
- many ways to display errors
- ...



Keep in mind:
- plots need to correctly represent data
- plots should communicate findings in a clear way
- too little or too much info
- overcrowded, hard to read
- master the art of plotting one step at a time

Common mistakes: results & discussion

- explain the experimental findings & connect to theory
- explanation needs to be qualitative & quantitative
- be exact
- explain all the methods used
- the structure of the report
- use scientific language (no slang)
- it takes time to learn, no worries
- the tricks of the trade

... the [quantity1] increased by a factor of 10 with increasing [quantity2]... ✓

... [quantity1] increased a lot when I increased [quantity2]... ✗

Common mistakes: results & discussion

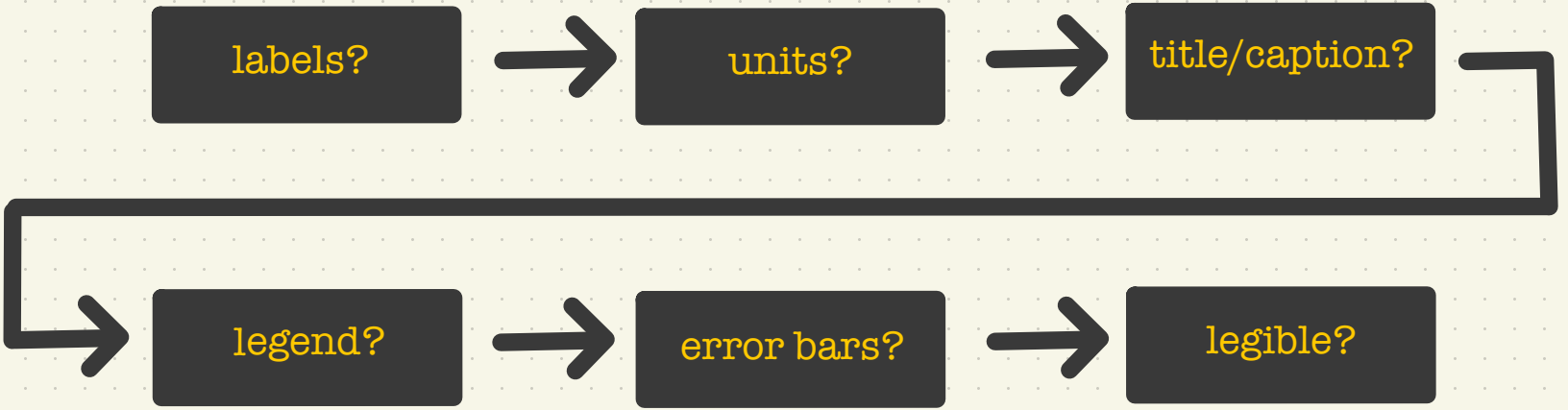
- check signs
- check units
- use dimensional analysis (powerful)
- compare to expected result/theory
- talk to your peers!!! peer review
- if result is unexpected, try to investigate why
- many reasons for the discrepancy
- is your result physical/does it make sense?

> "... using this method, it was determined that the distance to the Andromeda galaxy is 765 ± 2 km."

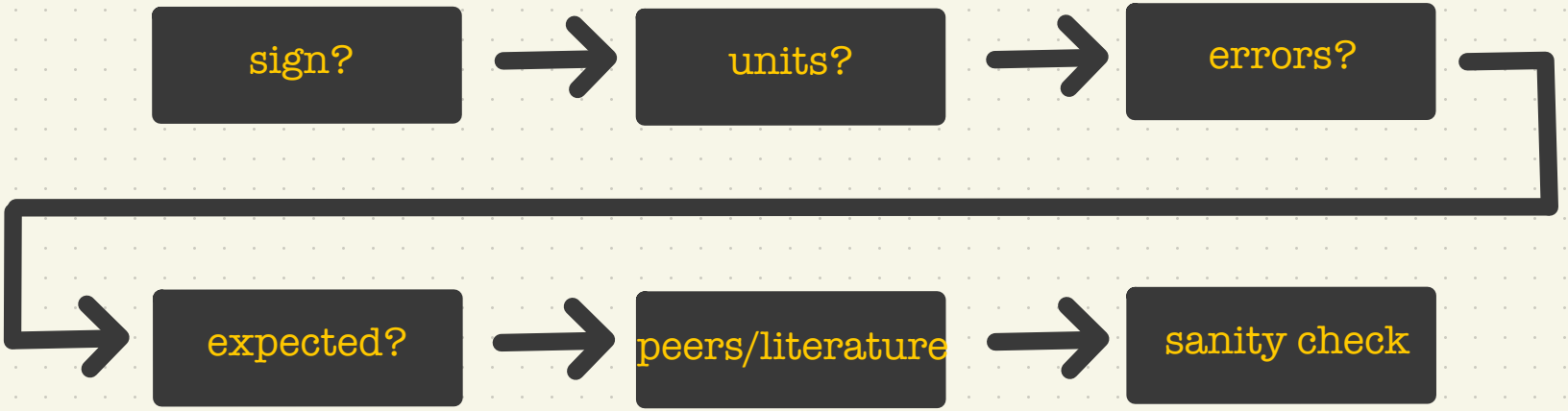
Tips & tricks

Useful questions to ask yourself:
- do I have units everywhere?
- is this the right fit for my data?
- is my plot legible?
- does my plot have all the necessary information?
- am I presenting the right variable?
- does this result make sense?
- is this supposed to be negative?
- does the theoretical value agree with the experimental?

Tips & tricks: data analysis



Tips & tricks: results



Tips & tricks: general

- dimensional analysis
- peer review & discussion
- try to comment each other's report
- learn from mistakes
- you will improve, I promise
- you are already very good (you are physics students)
- no stress
- UNITS
- no worries (also, UNITS)
- keep lab notes on hand
- explore software
- think about how to best show your findings
- save your portfolios and come back to them in a year or two
- we (seniors) also made mistakes
- we (seniors) also make mistakes

Take home message(s)

- labs offer you a first taste of the scientific method
- if you made mistakes, it is ok, you will learn
- everyone makes mistakes
- take this opportunity to reflect rather than stress
- HAVE FUN as physics is truly grand