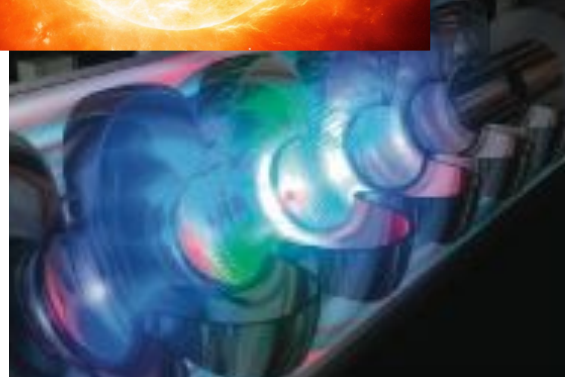
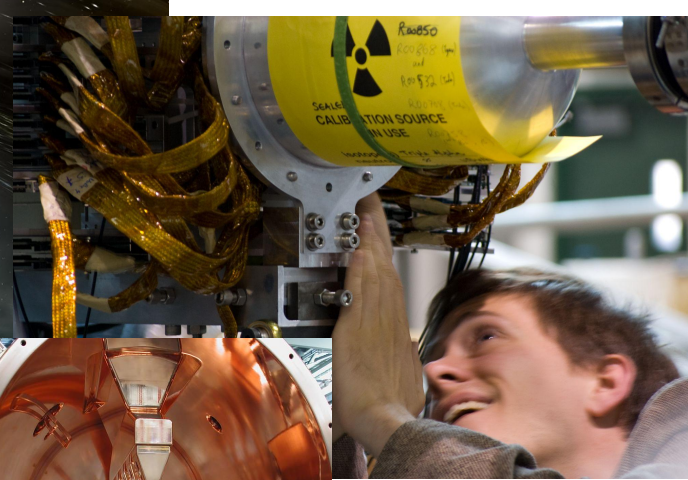
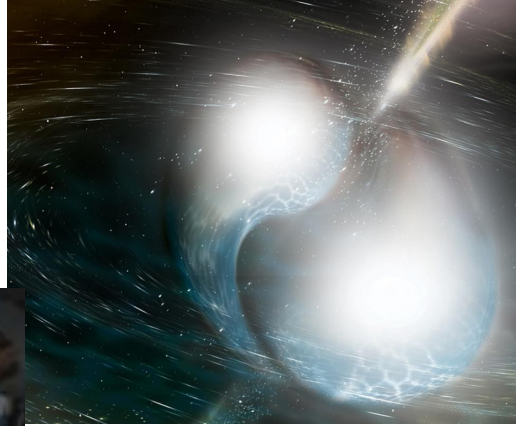
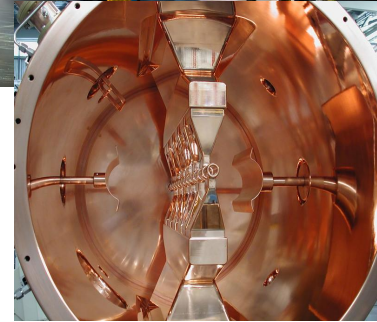


Binding Blocks

Down-to-Earth Nuclear Physics



*STFC NP Summer
School, July 2026*

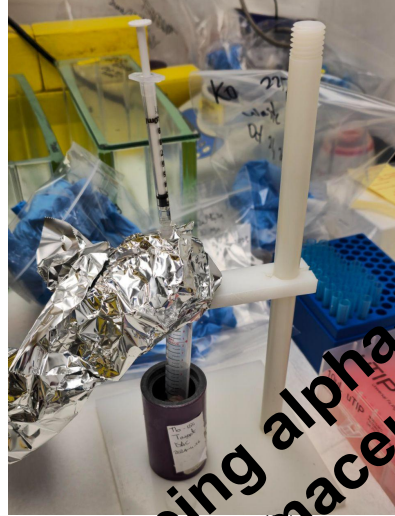


Dr. Christian Aa. Diget

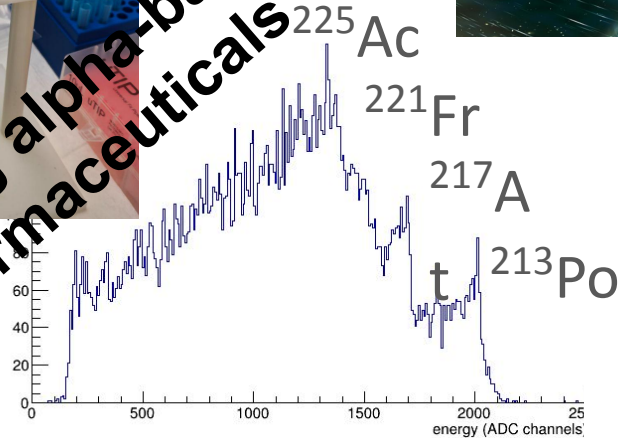


Research for a living

- live research -



Developing alpha-based
radiopharmaceuticals

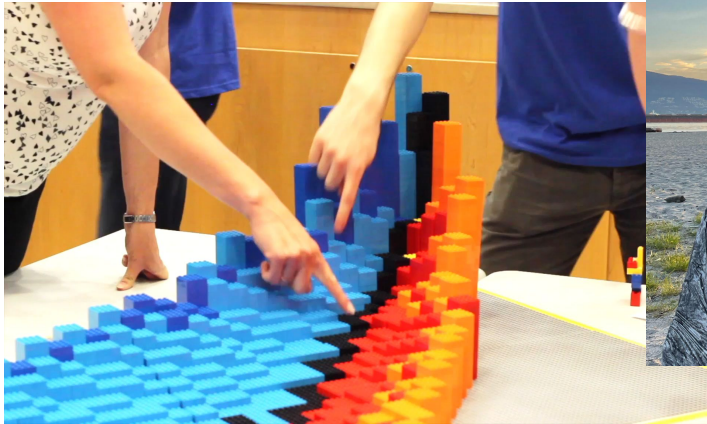


Life as a researcher

- research life -

Science, sunsets and the sea

- talking about science
- enjoying the road



Elements and Isotopes

H1

He2

Li3

Be4

Na11

Mg12

K19

Ca20

Rb37

Sr38

Cs55

Ba56

Fr87

Ra88

Sc21

Ti22

V23

Cr24

Mn25

Fe26

Co27

Ni28

Cu29

Zn30

Y39

Zr40

Nb41

Mo42

Tc43

Ru44

Rh45

Pd46

Ag47

Cd48

La57

Hf72

Ta73

W74

Re75

Os76

Ir77

Pt78

Au79

Hg80

Ac89

Rf104

Db105

Sg106

Bh107

Hs108

Mt109

Ds110

Rg111

Cn112

B5

C6

N7

O8

F9

Ne10

Al13

Si14

P15

S16

Cl17

Ar18

Ga31

Ge32

As33

Se34

Br35

Kr36

In49

Sn50

Sb51

Te52

I53

Xe54

Tl81

Pb82

Bi83

Po84

At85

Rn86

Nh113

Fl114

Mc115

Lv116

Ts117

Og118

Ce58

Pr59

Nd60

Pm61

Sm62

Eu63

Gd64

Tb65

Dy66

Ho67

Er68

Tm69

Yb70

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Am95

Cm96

Bk97

Cf98

Es99

Fm100

Md101

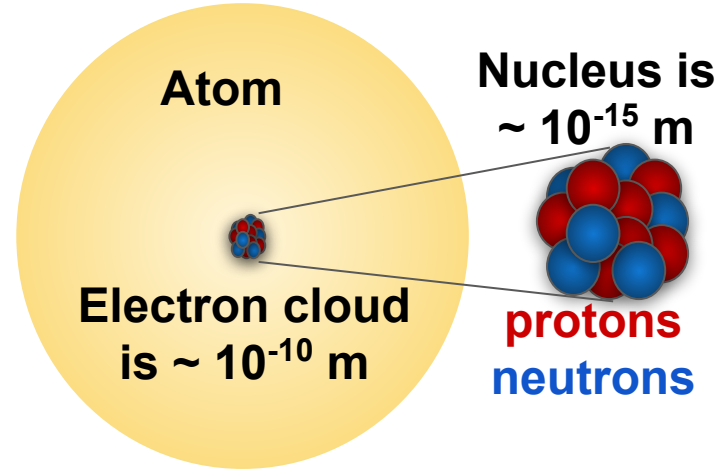
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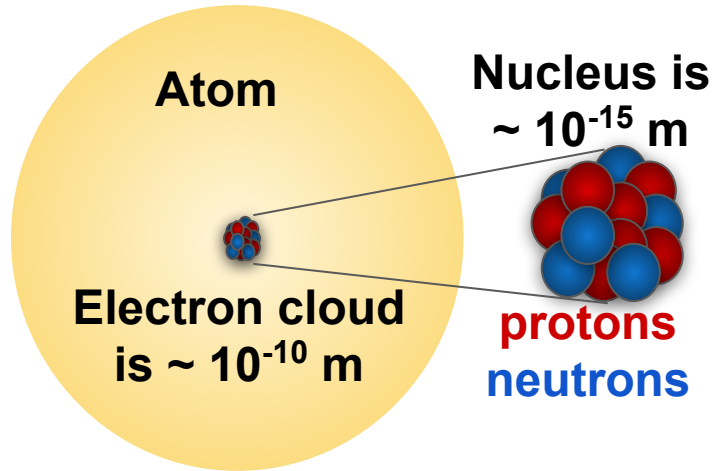
Periodic table taken from Royal Society of Chemistry. Interactive version available at:

Periodic table taken from Royal Society of Chemistry interactive version available at

<https://www.rsc.org/periodic-table>



Elements and Isotopes



Me:	$\sim 1 \text{ m}$
Human cell:	$\sim 10^{-5} \text{ m}$ ($10 \mu\text{m}$)
Atom:	$\sim 10^{-10} \text{ m}$ ($\text{\AA}$)
Nucleus:	$\sim 10^{-15} \text{ m}$ (fm)

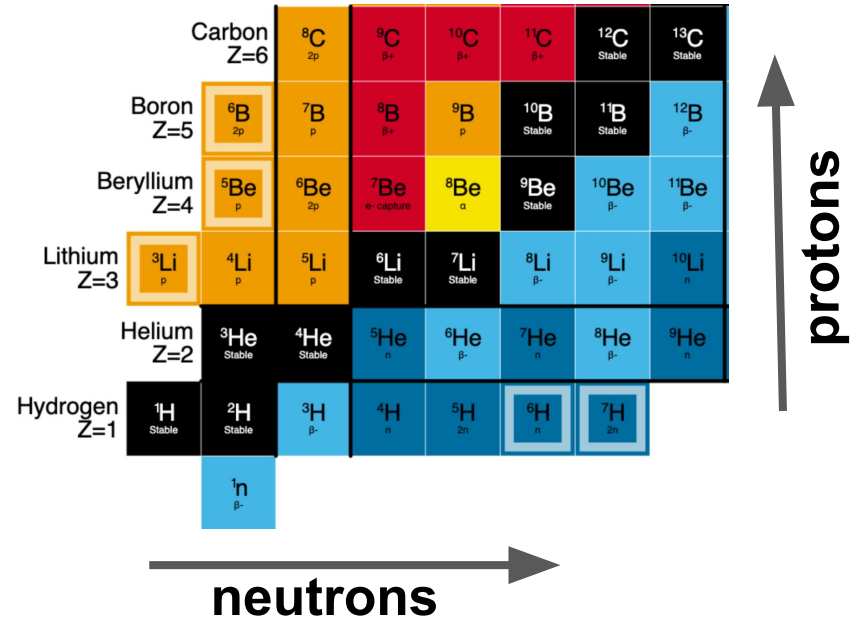


Elements and Isotopes

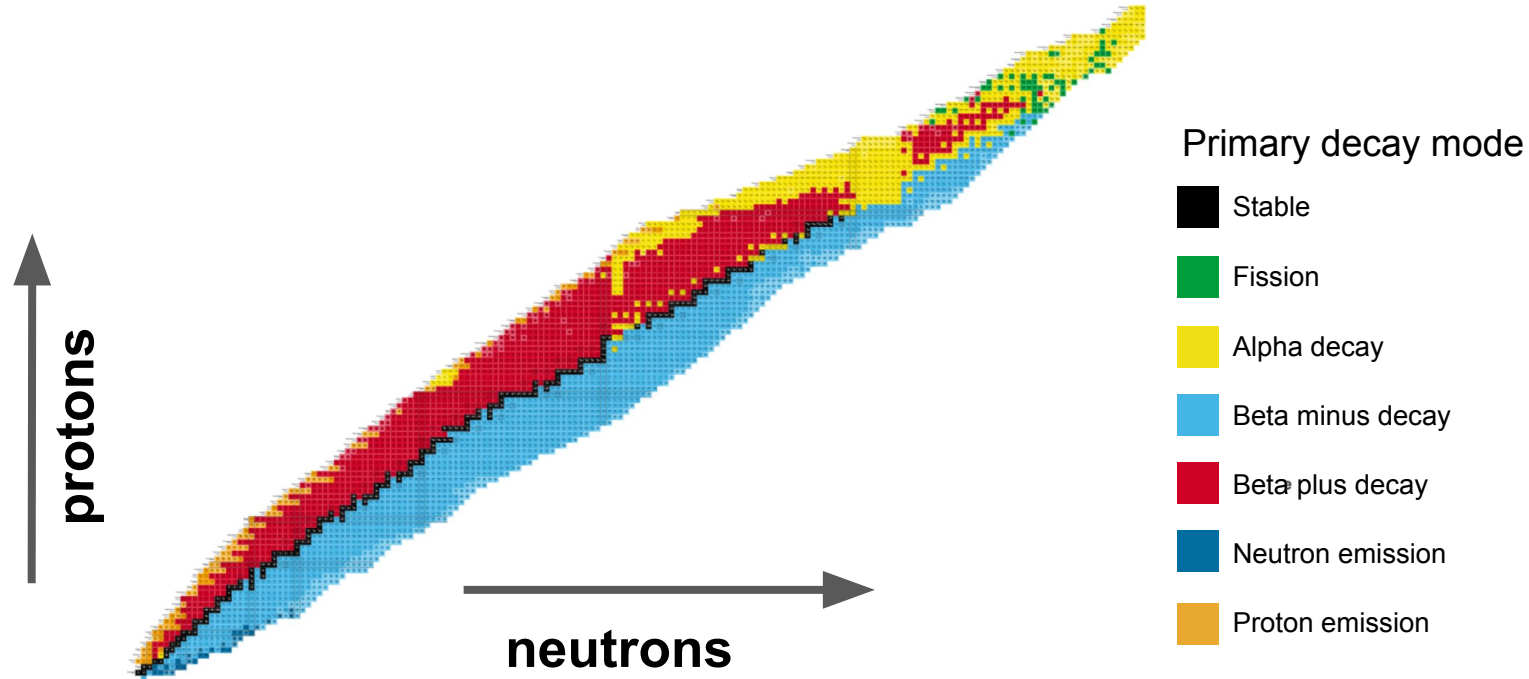
Nucleons (A), protons (Z), and neutrons (N)

Periodic Table																	
H 1																	He 2
Li 3	Be 4	The Royal Society of Chemistry's interactive periodic table features history, alchemy, podcasts, videos, and data trends across the periodic table. Click the tabs at the top to explore each section. Use the buttons above to change your view of the periodic table and view Murray Robertson's stunning Visual Elements artwork. Click each element to read detailed information.															
Na 11	Mg 12	B 5	C 6	N 7	O 8	F 9	Ne 10	Al 13	Si 14	P 15	S 16	Cl 17	Ar 18				
K 19	Ca 20	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36
Rb 37	Sr 38	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54
Cs 55	Ba 56	La 57	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86
Fr 87	Ra 88	Ac 89	Rf 104	Db 105	Sg 106	Bh 107	Hs 108	Mt 109	Ds 110	Rg 111	Cn 112	Nh 113	Fl 114	Mc 115	Lv 116	Ts 117	Og 118
		Ce 58	Pr 59	Nd 60	Pm 61	Sm 62	Eu 63	Gd 64	Tb 65	Dy 66	Ho 67	Er 68	Tm 69	Yb 70	Lu 71		
		Th 90	Pa 91	U 92	Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	Es 99	Fm 100	Md 101	No 102	Lr 103		

Periodic table taken from Royal Society of Chemistry. Interactive version available at:
<https://www.rsc.org/periodic-table>



Elements and Isotopes



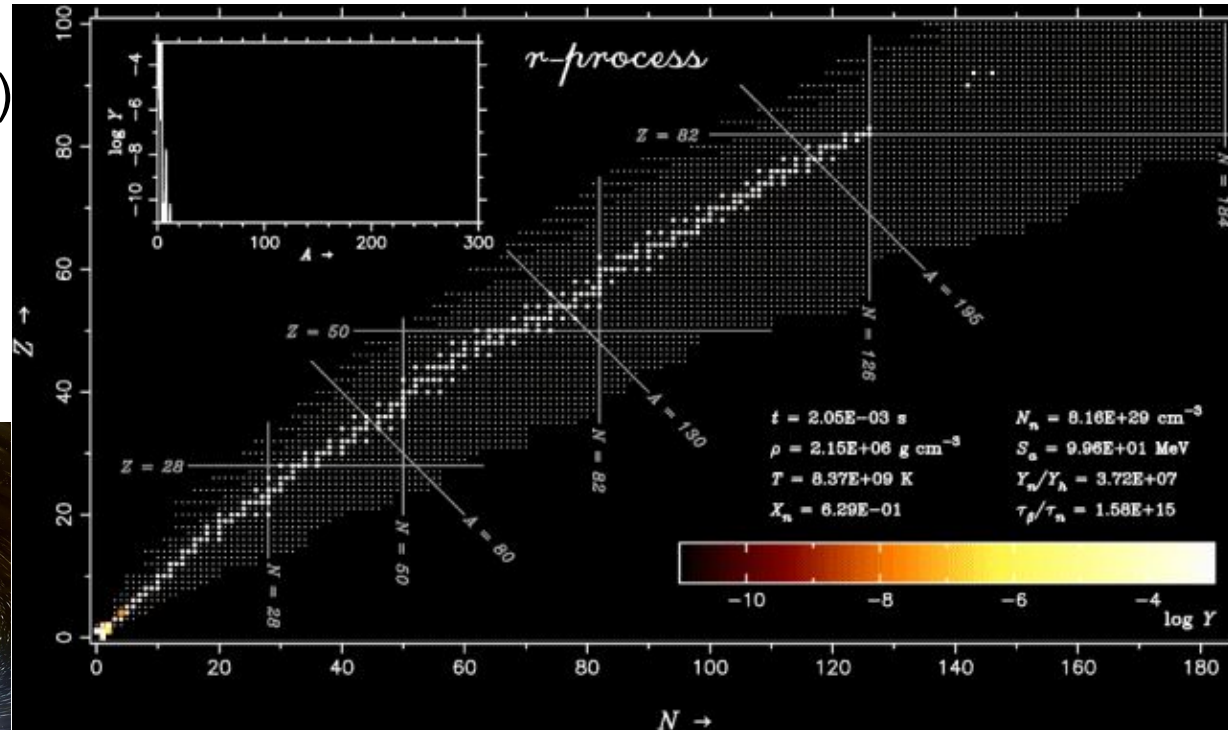
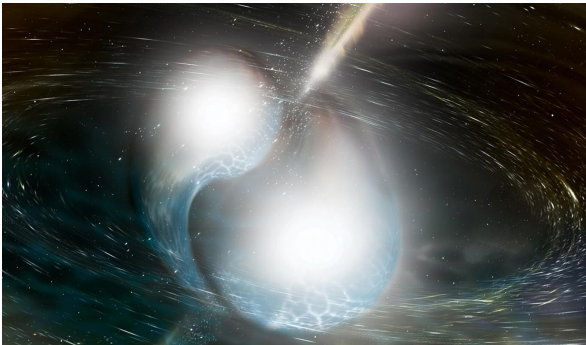
Colourful Nuclide Chart by Dr. Ed Simpson, The Australian National University. Interactive version available at:
<https://people.physics.anu.edu.au/~ecs103/chart/>



Creating Elements

New elements in stars (in neutron-star mergers)

- Neutron absorption:
 $^{58}\text{Fe} + n \rightarrow ^{59}\text{Fe} \text{ (Z=26)}$
 → new isotope
- Beta minus decay:
 $n \rightarrow p + e^- + \bar{\nu}_e$
 → new element



Creating Elements

The first elements: energy from fusion to helium

4 (Be)		Be	34	17	14	8
3 (Li)	Li	42	29	14	14	13
2 (He)		He	24	7	14	16
1 (H)	H	33	30	24	29	30
0 (n)		(n)	36			

3	4
---	---



Fusion energy ($D + D \rightarrow {}^4\text{He} + E$):

$M_D = 2.014102 \text{ u}$ and $M_{{}^4\text{He}} = 4.002603 \text{ u}$
 ($u = 1.661 \cdot 10^{-27} \text{ kg}$, $c = 299,792,458 \text{ m/s}$)

$$\begin{aligned}
 E &= 2 \cdot M_D c^2 - M_{{}^4\text{He}} c^2 = 0.025601 \text{ uc}^2 \\
 &= 3.8 \cdot 10^{-12} \text{ J} \\
 &= 3.8 \text{ pJ (excess energy difference)}
 \end{aligned}$$

$$\begin{aligned}
 E (4\text{kg D}) &= 0.025601 \text{ kg} \cdot (299,792,458 \text{ m/s})^2 \\
 &= 2301 \text{ TJ}
 \end{aligned}$$

$$E (1\text{kg D}) = 2301 \text{ TJ} / 4 = 575 \text{ TJ}.$$

From deuterium in 1L of water:

- $1\text{kg} \cdot 2/18 \cdot 0.00023 \cdot 575 \text{ TJ/kg} = 15 \text{ GJ}$

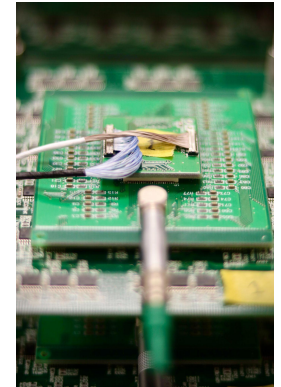
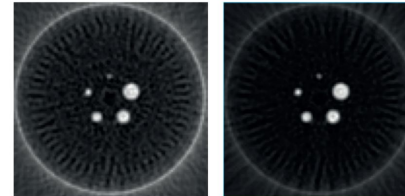
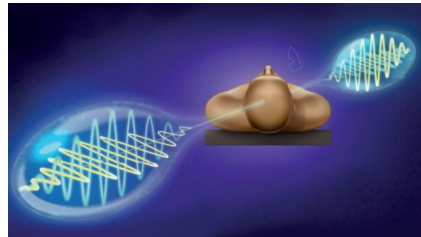
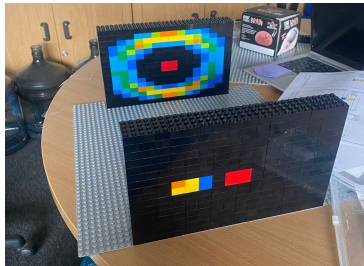
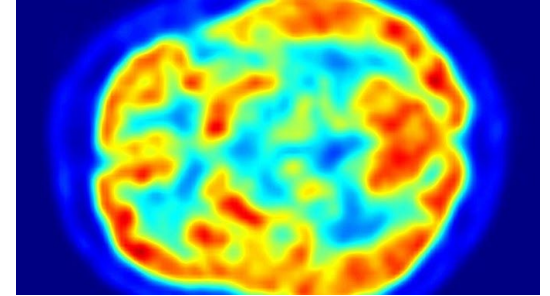


Nuclear Research

From stars to medicine...

Nuclear physics is about far more than just nuclear power. Researchers are studying:

- The shapes of nuclei
- Cancer treatments and medical imaging;
- Exotic nuclei (highly unstable nuclei that only exist for fractions of a second)
- Nuclear detectors used for national security;
- How stars produce different chemical elements
- How we can use the processes happening inside stars to generate electricity here on Earth.



Examples of previous introductions: Find your own style!

Examples:

- Introduction to Siddharth Doshi
- Research slides from Chloe McGeorge

Submit (up to) two slides about you
and two slides about your research to:
Binding Blocks

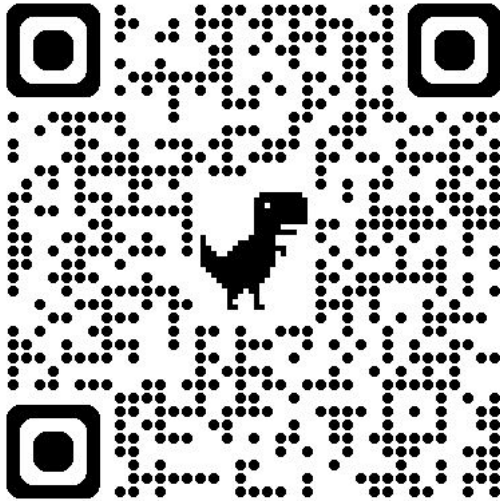
<physics-bindingblocks@york.ac.uk>

Deadline Tuesday 4th Aug 12:00

Winner announced at the end of the
STFC NP Summer School



Ten hundred words



Randall Munroe's Simple Writer tool:
an editor inspired by his comic Up
Goer Five and book Thing Explainer.

The tool checks your writing in real
time and highlights any word that isn't
among the 1,000 most used words,
encouraging you to explain complex
topics using only simple language.

