



THE UNIVERSITY
of EDINBURGH

Let's play

Quark Quest

(and friends)

Nuclear- and particle-physics board games for fun and (maybe) profit



Cheryl Patrick
IPNP meeting, June 2025

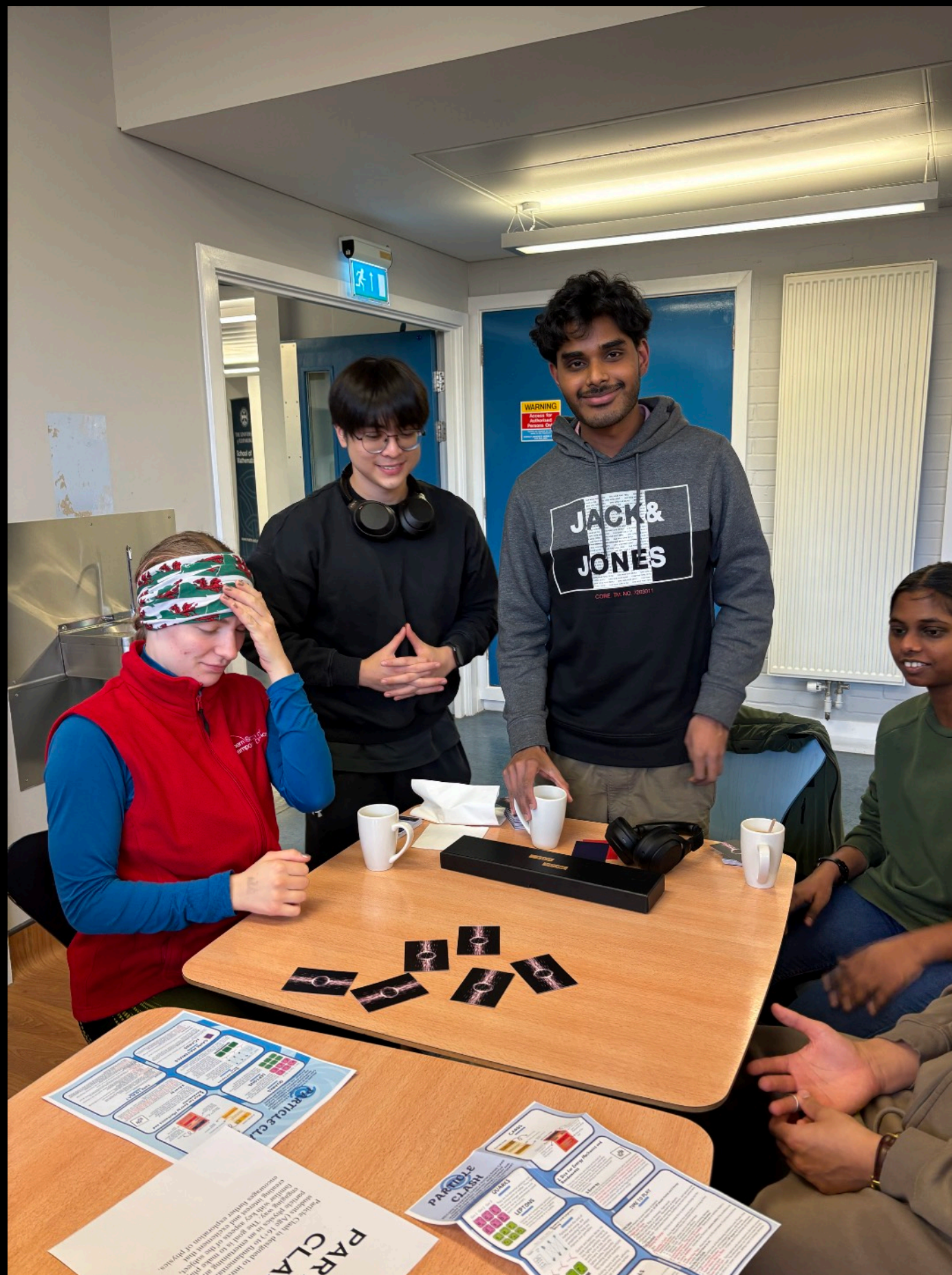


Where the ideas happen

MSc in Particle and Nuclear Physics - Research Skills group project

Want a sneak peek next year?

Board games tea-party with the students
mid-semester 2



Science fair



Wide age range:
accessible gameplay



Intrigue and inspire:
no detail needed

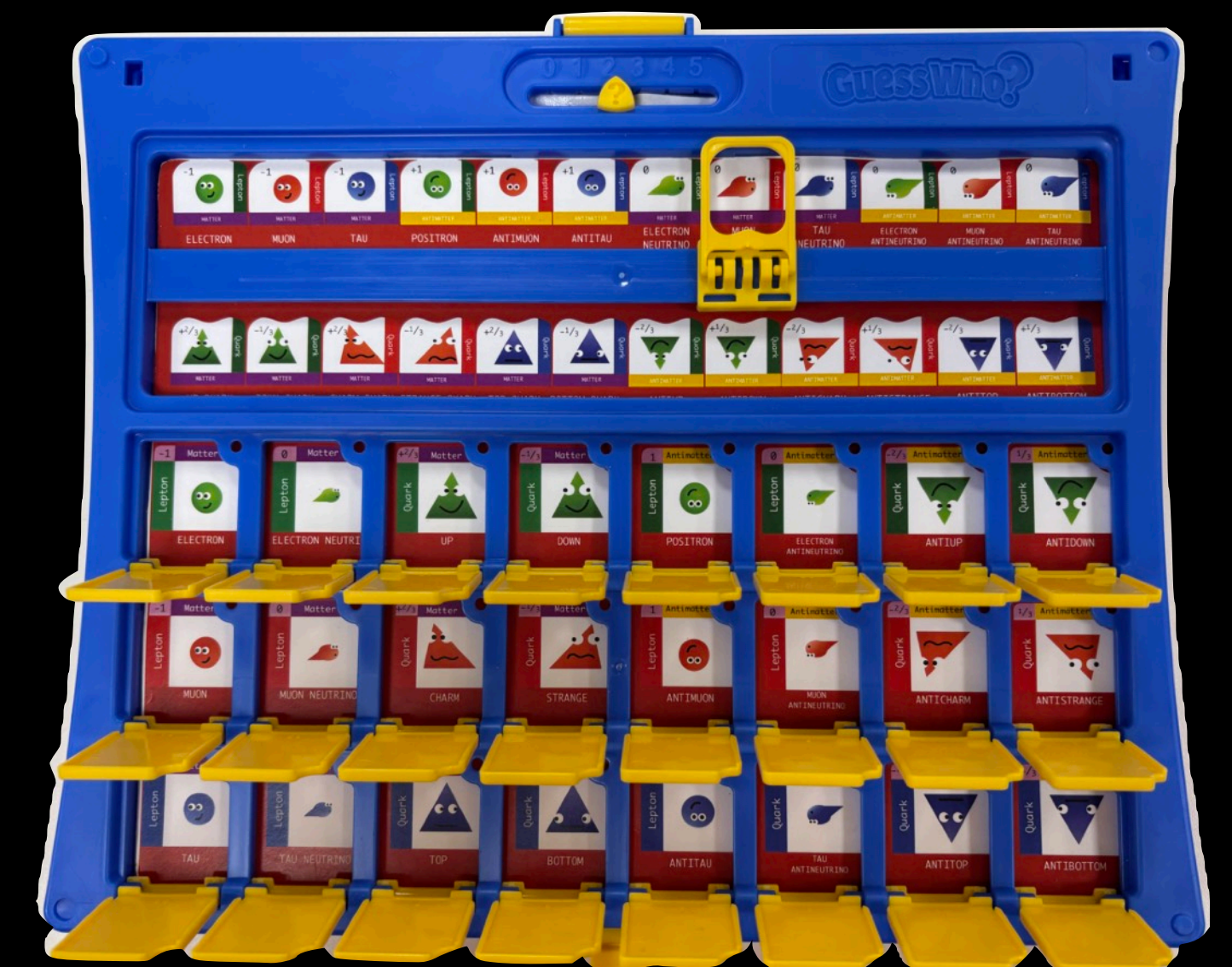


Short visits of 5-10 mins:
immediate impact



Competing activities:
eye-catching

Created by Alex Bullock, Mathai Joseph &
Elian Ruijter



e.g. Particle Party
(Guess Who?)

Classroom



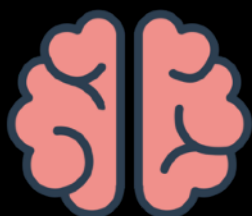
Well-understood target audience:
tailor to syllabus



Captive audience:
anything's better than school



Time-limited:
~ 45 min class



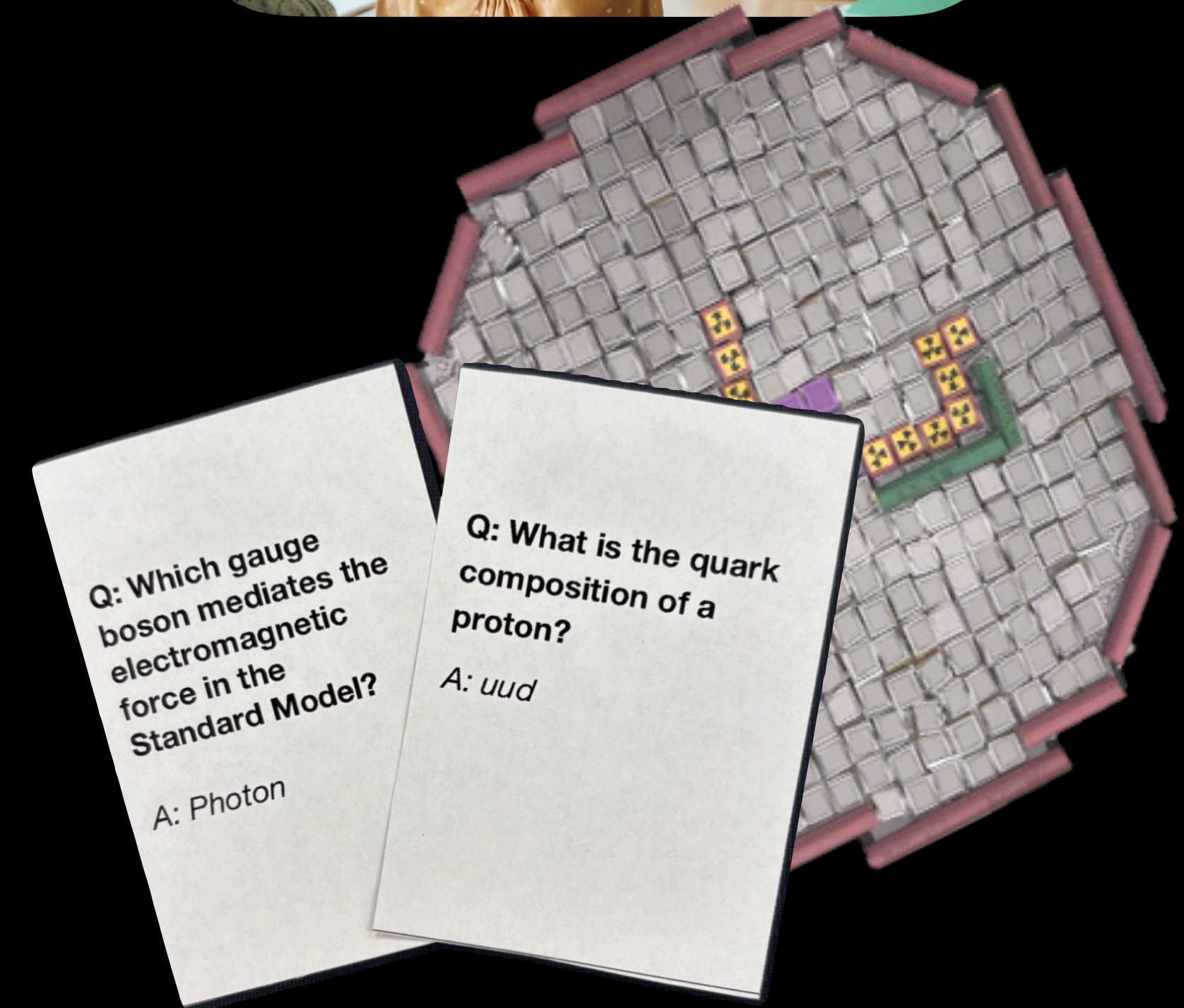
No replay:
learn everything first time



~30-student classes:
scalability vs. cost



e.g. Reactor
Runaway
(revision quiz)



Created by Jack Henderson, Dan
Coppersthwaite-Lewis, Ailsa Evans & Chenxi Cao

Nuclear Nonsense (needs development)



- Collect isotopes from the table of nuclides
- Learn β^- , α and β^+ decays
- Experience the valley of stability
- Play as famous physicists - with superpowers!

Created by Finn Onori, Michael McGlynn,
Bastian Nijman and Jordan Wolken



At home



Mixed audience:
work at multiple levels



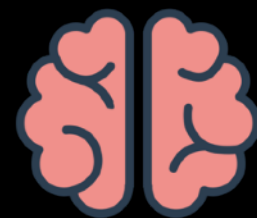
Lots of other options:
fun, appealing



Buy for family or as gift:
eye-catching, high-quality,



No time constraint:
complex gameplay / content OK

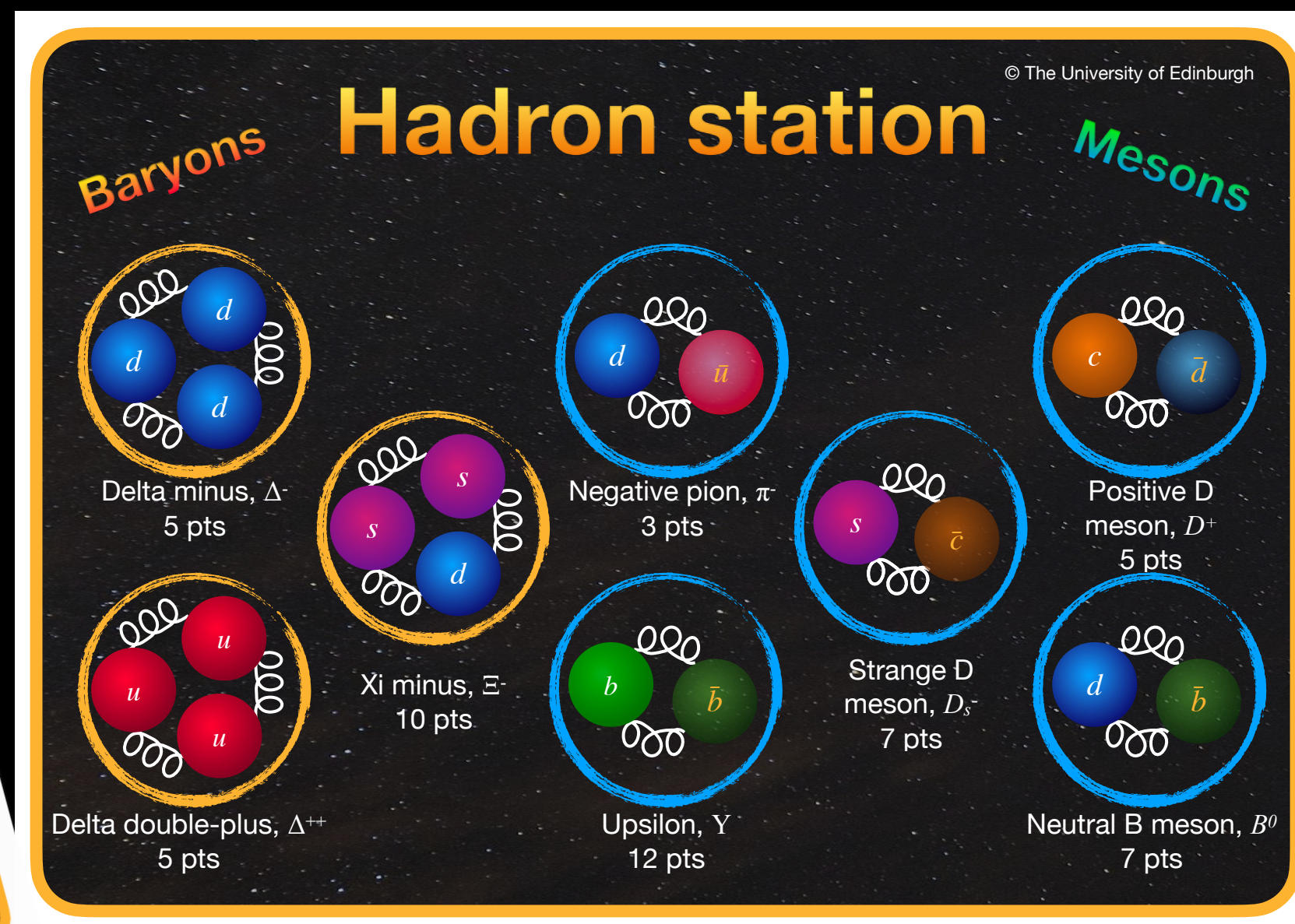
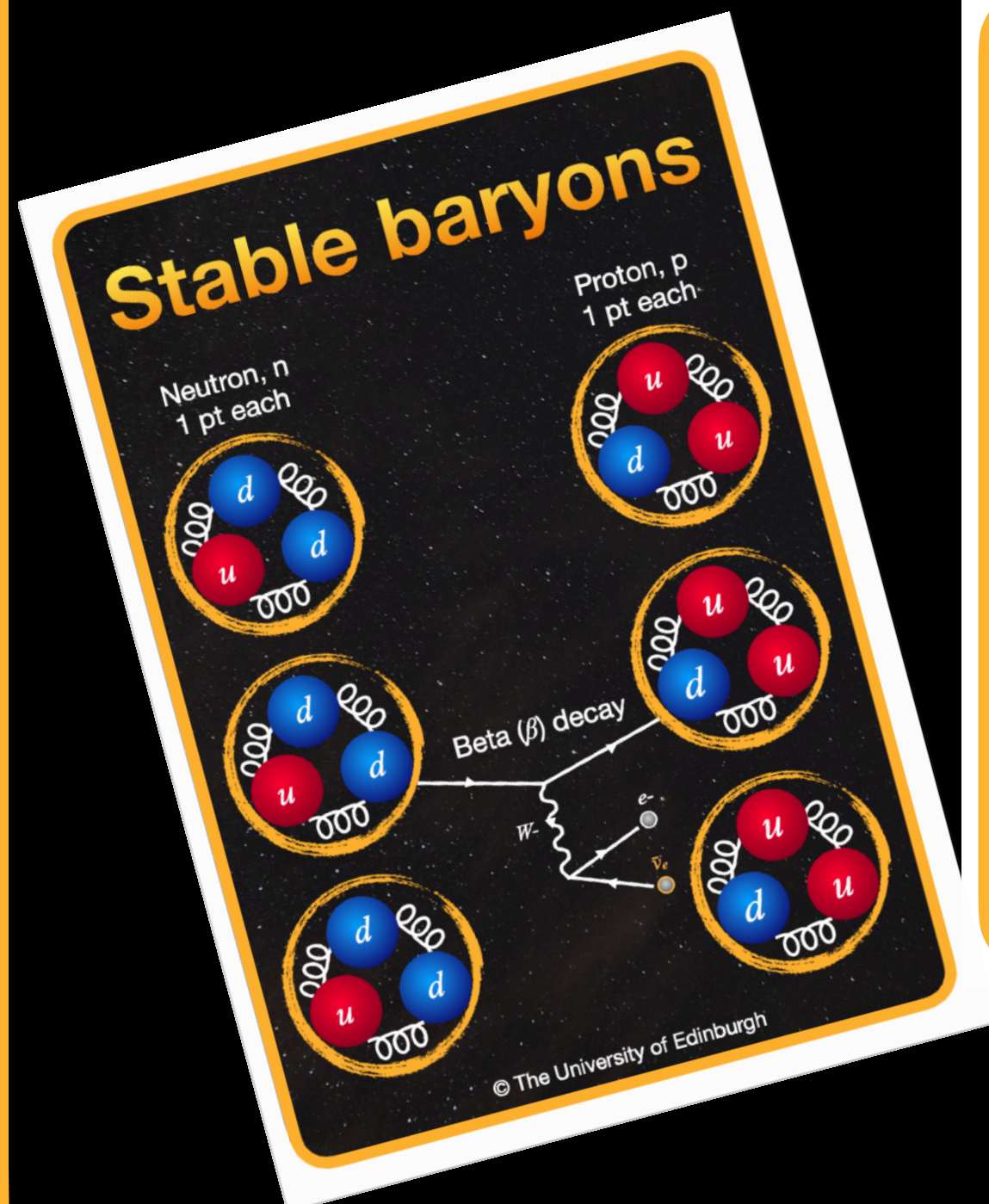
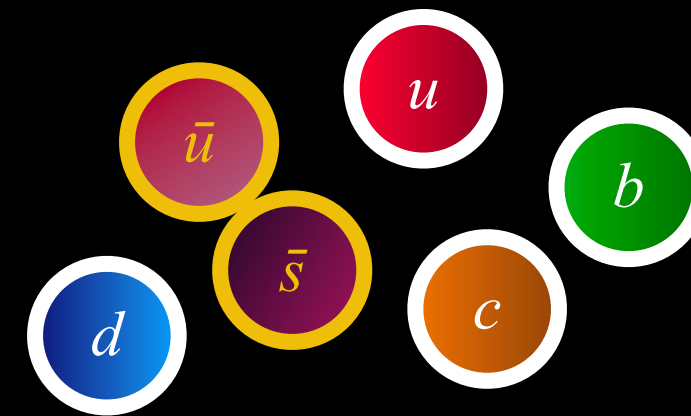


Replay value:
variety, continued learning

Can we do this with a physics game?

Quark Quest

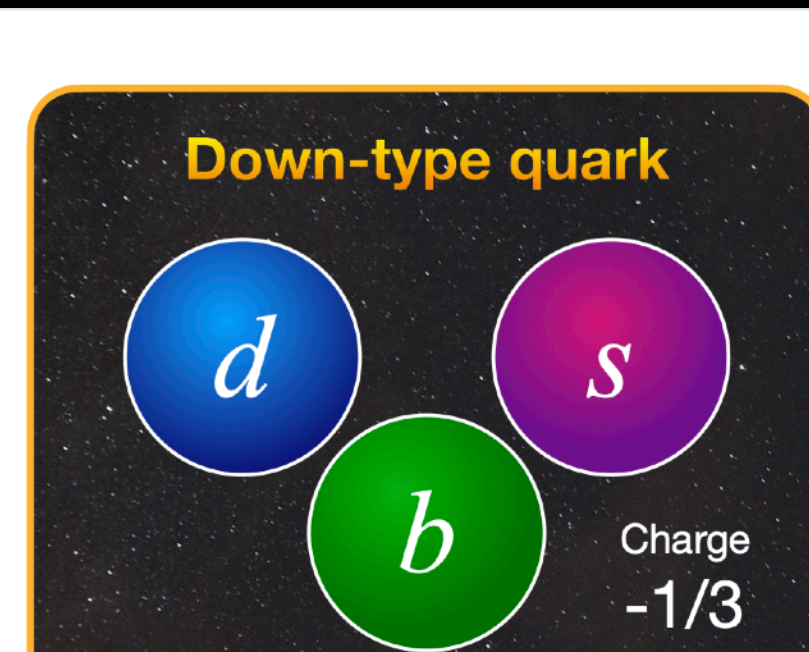
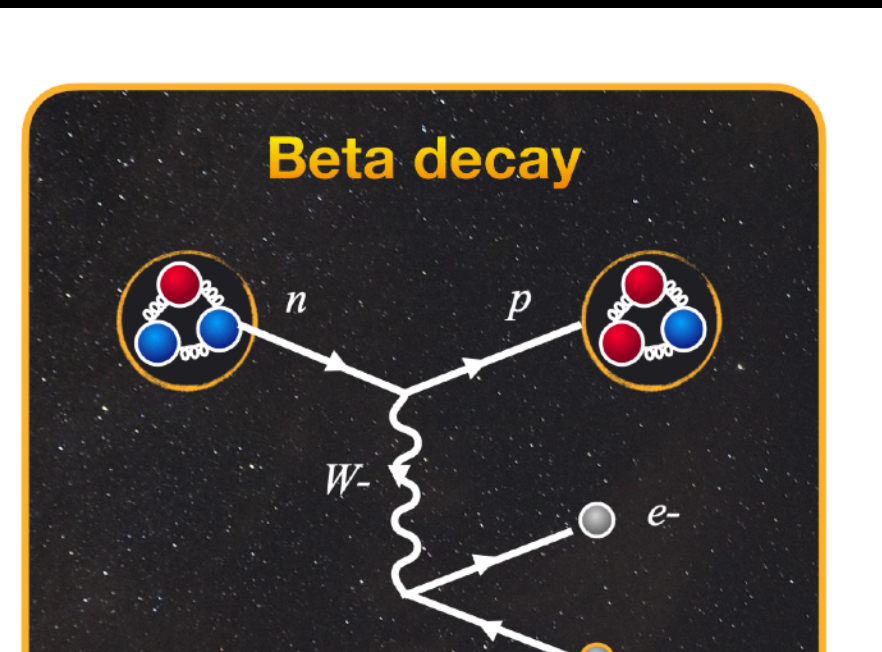
Our most developed game



Created by Jamie Jones, Samiha Sehgal, Nicole Yaghnem & Jiacheng Shi

22 different cards with actions and physics

based on the Scottish Higher curriculum



Electromagnetic interaction

Choose one of your free quarks or antiquarks. Find another player with its antiparticle. Discard both, and choose a new quark-antiquark pair. Keep one; the other player gets the other.

A quark-antiquark pair can annihilate to produce a photon, the carrier of the electromagnetic force. This then decays, creating a new quark-antiquark pair (or a lepton-antilepton pair).

a neutron on you
rd, replace it with
n and antineutrino
get away).

ay via the weak force
an uncharged, invisib
ally an electron anti
ne decay energy. Thi
ow neutrinos were di

Higgs boson

Roll one die, and collect a quark-antiquark pair based on your roll:

1	:	$c\bar{c}$
2-3	:	$b\bar{b}$
4-6	:	$t\bar{t}$

The Standard Model predicted the Higgs boson and, in 2012, it was discovered at the Large Hadron Collider. Higgs bosons couple to particles' mass, and so they usually produce heavy quarks.

own-type quark c
wn, strange, or b

ve quarks – the down,
all have a negative c
electron's charge.

Proton-proton collider

If you have a proton, discard it. Pick another player to do the same. Then, without looking, each take 6 quarks or antiquarks. If no other player has a proton (or if you don't), do nothing.

The Large Hadron Collider looks for new physics by smashing protons together at high energies, producing lots of quarks, antiquarks, and other particles.

ct player to skip t

matter exists from s
we've never seen it in
of matter. Now the ne
either!

Particle accelerator

Roll the dice again and take another turn.

Evidence that quarks exist comes from high-energy collisions between electrons and nucleons at particle accelerators. Now, accelerate yourself!

Goal for summer - get it purchasable!

Quark Quest Classic

High-quality,
replayable family
edition



Professional manufacturing



New art ?



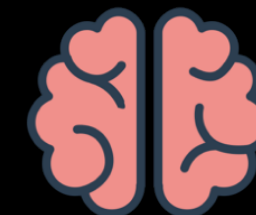
Basic and advanced cards?

Quark Quest Classroom

Budget, learning-
intensive schools'
edition



Highers language



Pared-down card set



Cheap materials, option to print PDF

Welcome summer student Andrew Cunningham

Particle and nuclear-physics outreach | General | Microsoft Teams

