UNIVERSITY OF BIRMINGHAM | SCHOOL OF PHYSICS AND ASTRONOMY

Particle Physics for Primary Schools – enthusing future Physicists

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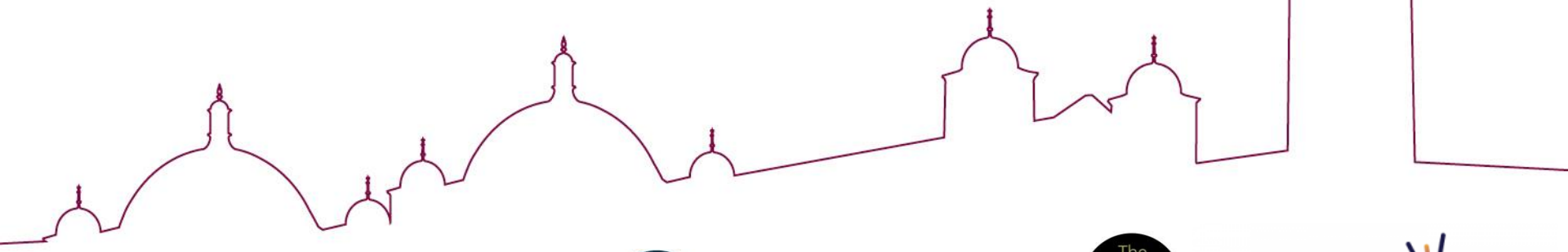

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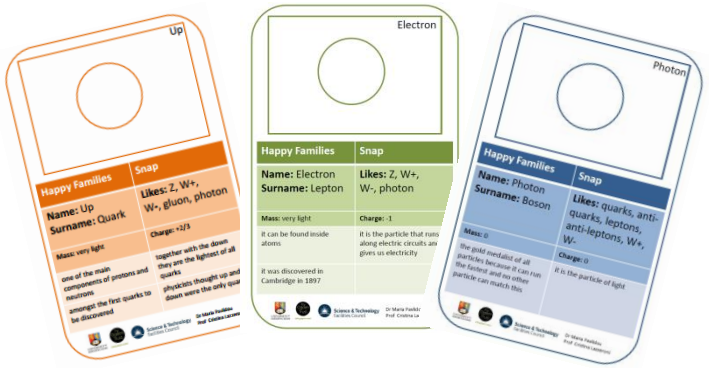
Why targeting primary schools?

- children develop awareness and attitudes towards STEM related careers at an early age [1]
- children hear in the news about CERN and the discovery of new particles and ask questions to their teachers
- particle “families” and interactions can be understood at a basic level due to their similarity to human family dynamics

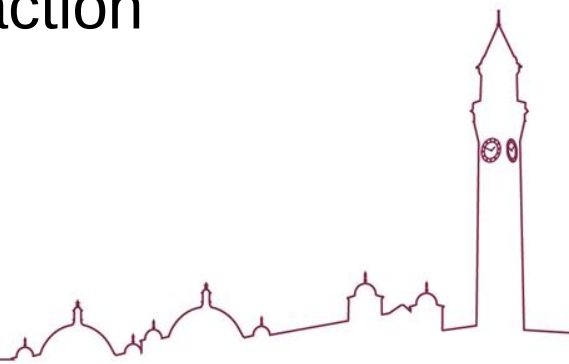
Learning through playing [2]

- Use of fluffy toys to visualise the particles
- Card games to familiarise with the particle families
- Freedom of choice on creative ways to express ideas



Structure of workshop

- Introductory talk
- “Happy Families” card game to learn particle families
- Particle model making, using plasticine (for mass), plastic balls and decoration materials
- “Snap” card game to learn particle’s “likes” and “dislikes”
- Creative writing/playing to show the interaction between particles that “like” each other



Examples of ideas delivered

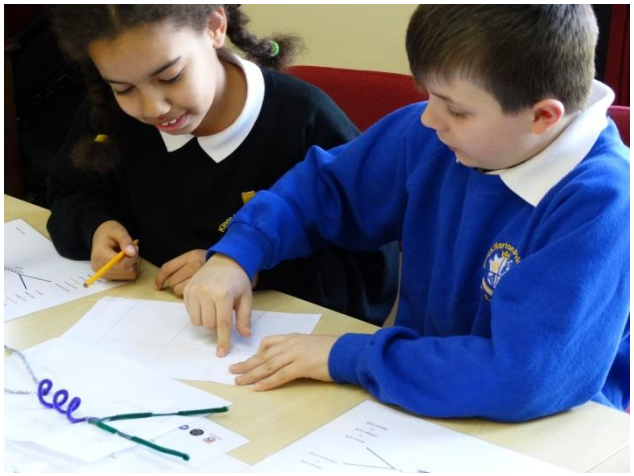
- Matter is structured like Russian Dolls (particles inside particles)
- The LHC is a motorway for particles
- Destroying particles (through collision) allows us to discover what they are made of
- The ATLAS detector at CERN is a very fast digital camera
- Particles are grouped into families: quarks, leptons, bosons, anti-quarks, anti-leptons
- Particles interact only with particles they “like”

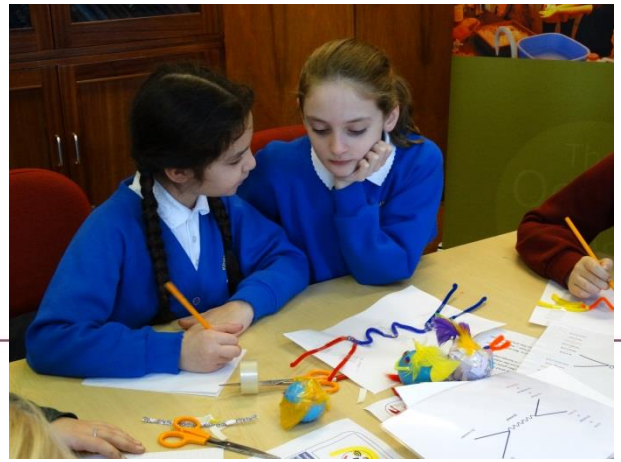
Making particle models

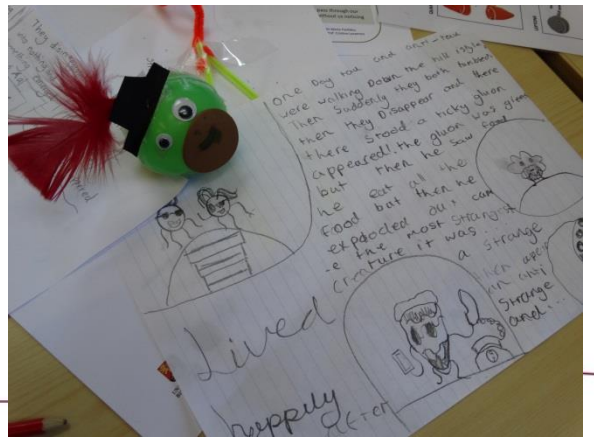
- plasticine inside ball makes particle model “heavier”
- Matter-antimatter pairs are identical apart from one characteristic called “charge”

Creative approaches to learning: particle interactions [3]

- structure of story provided via Feynman diagram
- Example stories provided to give inspiration
- Freedom of choice on type of activity and performance







Evaluation

Two student questionnaires: immediately after and a month later

- 100% could describe new acquired knowledge after a month
- 93% explained what they learned to friends and family
- 93% admitted they are more interested in science as a result
- 80% said the day made them more excited about going to University

Publicity

- Resources translated into Greek and used by

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- Resources used in 12 UK Universities with the support of

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- Resources used by

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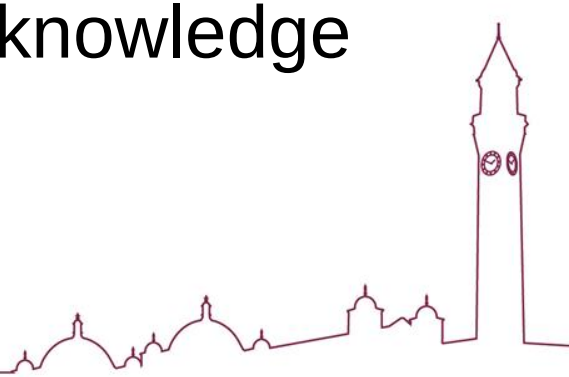
Conclusions

- Creative approaches to learning is a powerful tool to enthuse young students towards physics
- Primary schools should be allowed to engage with modern physics – it aids motivation in tackling the perceived difficulty of the subject
- learning through playing indicates knowledge is sustainable for longer periods



The Particle Song by N Rukandema and A Moody *(sing to the tune: "I will survive")*

One day a little muon
Walked out his door
He had opened up his curtains
And swept the floor

But after getting up
And recovering from his dream
He opened up
And this is what he's seen

It was a muon
Muon neutrino
He was walking down the street
Drinking vino

And once their eyes met
For the first time muon thought
He found love
And wasn't scared at all

And poof like that
They disappeared
They ran away inside
Could not be heard

And in their place
Was a W-minus
It just appeared
No reason to be feared

It ran outside
Onto the street
Until it bumped into a lamppost
And fell onto its feet

But coming in the distance
Could be seen an anti-charm
What was this?
A beauty on its arm

Another pair
With loving hearts
They rode off into the sunset
Arm in arm

And here is the end
Of our classic tale of chance
We say goodbye
Goodbye from us!

References

[1] van Tuijl, C. & van der Molen, J.H.W. *Study choice and career development in STEM fields: an overview and integration of the research,* Int J Technol Des Educ (2016) 26: 159. doi:10.1007/s10798-015-9308-1

[2] Honey, M. & Kanter, D. E. *Design, Make, Play: Growing the Next Generation of STEM Innovators*, 1st ed. New York [u.a.]: Routledge, 2013. Print.

[3] Root-Bernstein, *Arts and crafts as adjuncts to STEM education to foster creativity in gifted and talented students*, R. Asia Pacific Educ. Rev. (2015) 16: 203. doi:10.1007/s12564-015-9362-0