

Particle Physics Workshop for Primary School children

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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

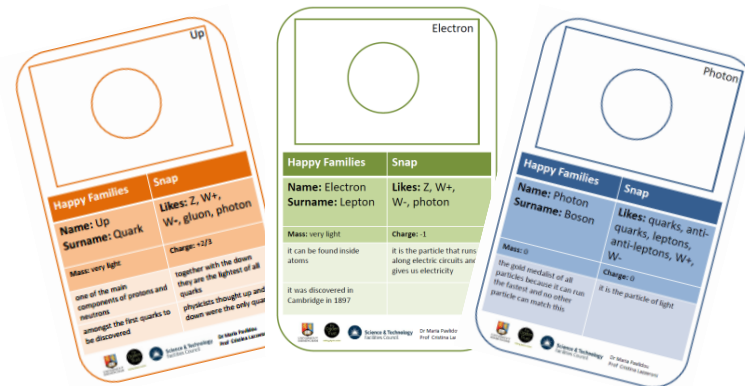
**Developed in co-creation with Ogden Trust
local primary teacher**

Learning through playing [2]

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



The PARTICLEZOO



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

“Proper” science 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”

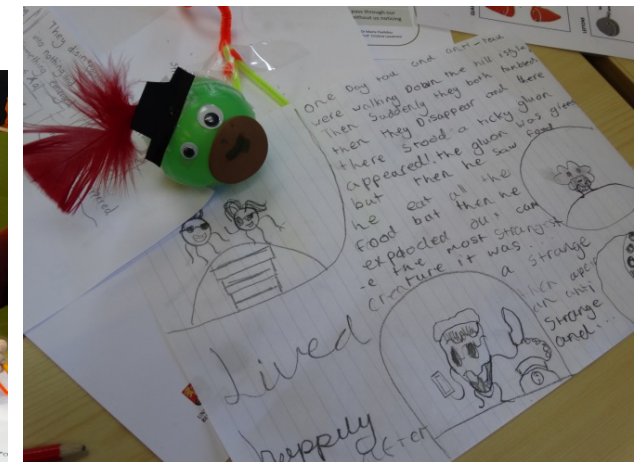
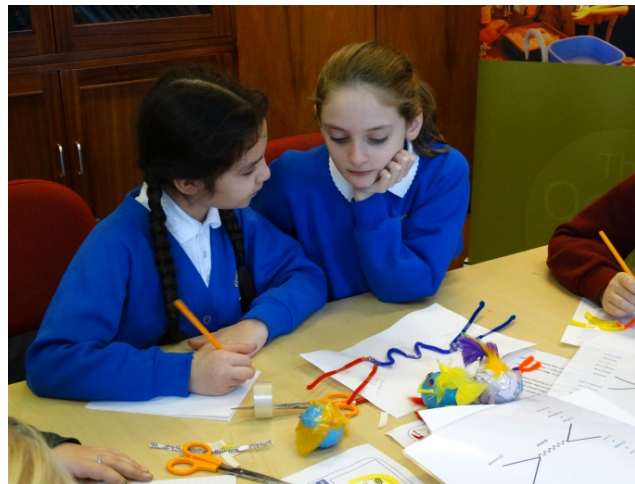
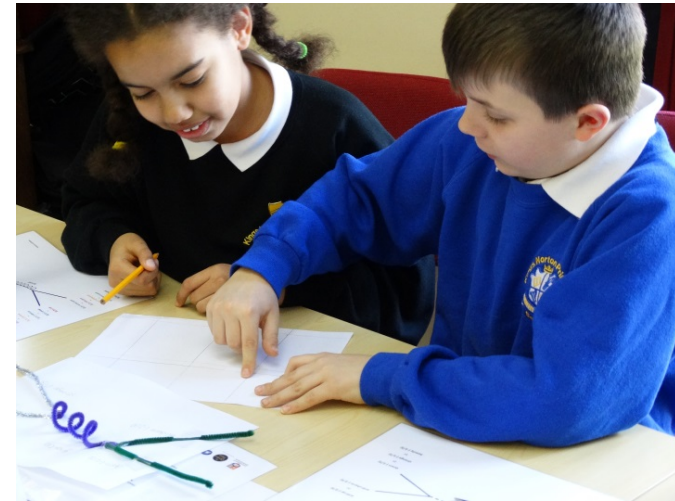
Making particle models

- 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: one immediately after and one 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

From MFS

- Activities were highly rated on being:
 - clear and informative
 - very engaging
 - Children learned new things
 - Physics feels now more accessible
 - Interest in physics has increased
- “I liked making things!”

National and International reach

- ❑ Translated in Italian and Greek
- ❑ Used in Primary schools in Milan and Athens
- ❑ Milan school adopted it as part of curriculum and now collaborating to extend it
- ❑ Used by CERN in teachers training programme
- ❑ Will be used by STEM ambassadors

Conclusions

- ❑ Creative approaches to **inclusive 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

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