





IRIS, the Institute for Research in Schools is also involved in this collaboration

# UK INVOLVEMENT IN MOEDAL

Adrian Bevan <u>a.j.bevan@qmul.ac.uk</u>



PPAP Meeting, RAL, July 2017



http://moedal.web.cern.ch

# PHYSICS PROGRAMME

- New physics search experiment at the LHC looking for highly ionising stable and long lived particles, including monopoles.
  - Complements other new physics searches
  - Uses passive detector components
- Documentation:
  - TDR:
    - <u>CERN-LHCC-2009-006, MoEDAL-TDR-001</u>
  - Physics Report:
    - Int.J.Mod.Phys. A29 (2014) 1430050 [arXiv:1405.7662]
  - First physics: trapping detector analysis: JHEP 1608 (2016) 067

2



#### PRL 118 (2017), 061801



Adrian Bevan (a.j.bevan@qmul.ac.uk)

# WHAT IS MOEDAL

- 7th approved LHC Experiment at CERN (build on existing CERN subscription investment)
  - 25 collaborating institutes with over 66 members
  - Location: In the LHCb pit.



#### Approved programme includes:

- Trapping detectors
- Nuclear Track Detectors
- Medipix sensors

#### Upgrade options includes:

- Long lived particle detection array (at SNOlab)
- MAPP detector for SUSY searches: location access tunnel
- Opportunities for innovation and technology development of interest for UK companies (machine learning, vision science, hardware for upgrade etc.).





# TRAPPING DETECTOR APPROACH



- Stacks of passive material (Al bars) are situated near the LHCb VELO and exposed to collisions.
- Highly ionising stable particles with magnetic charge can be trapped in material.
- Use a SQUID magnetometer to search for presents periodically.
  - Can extend approach to beam pipe material.
  - Can extend approach to decommissioned service material from the GPDs.



# NTD APPROACH





- Stacks of plastic detectors (NTDs) can be used to search for highly ionising particles.
- Etching the plastic after exposure can reveal pits that can be analysed for passage of electric or magnetically charged particles.
- Use pattern recognition and modern deep learning techniques to reconstruct
  candidate new physics
  events.

Several pathways to impact related to this work.



### THE MOEDAL COLLABORATION

University of Alberta University of Alabama University of Bologna University of British Colombia CERN University of Cincinnati Concordia University Czech Technical University in Prague Gangyeung-Wonju National University University de Geneve University of Helsinki Imperial College London

King's College London

Konkuk University

National University of Science and Technology (MiSIS), Moscow

University of Munster

Nanyang Technological University

Northeastern University

Queen Mary University of London

Institute for Space Sciences, Bucharest

Simon Langton School and the Institute for Research in Schools

Tuft's University

IFIC Valencia - CSIC and University of Valencia

Come and join a new physics search experiment at the LHC ...

66 Physicists 23 Institutes 13 countries

> Canada, Czech Republic, Finland, Germany, Italy, Korea, Russia, Romania, Singapore, Spain, Switzerland, USA, UK.



Adrian Bevan (a.j.bevan@qmul.ac.uk)