



STFC Science Highlights from the School of Physics and Astronomy (SPA)

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The SPA includes 3 STFC funded groups:

- Astronomy Unit
- Centre for Research in String Theory
- Particle Physics Research Centre

and a facilities user group: the Centre for Condensed Matter and Materials Physics

- World leading Russell Group University
- Medical School founded in 1785, with roots dating back to 1123 - St. Bartholomew's was established during the reign of Henry I
- 5th in the UK for percentage of research outputs ranked 4* and 3* (REF 2014)
- 8 Nobel Prize winners; including 2 physicists: Mansfield and Rotblat
- Marsden researched radioactivity at QM
- We had the UK's first University research reactor



- 50 academics
- 100 PhD students
- World class technical workshop, clean rooms and lab facilities
- Two prestigious UKRI Future Leaders Fellows
- Training networks including the STFC funded DISCnet Centre for Doctoral Training and we lead an 4M€ EU PhD training network
- Many discoveries and milestones for STFC science areas over the years, from the discovery of bosons: W, Z and H through to exoplanet discoveries and new moons of Saturn and the modern reboot of string theory

Astronomy Unit

- The AU undertakes world-leading research in the areas of
 - Cosmology and relativity
 - Planetary formation and dynamics
 - Space, solar, and astrophysical plasmas
- The group is heavily involved in the Euclid, LSST, SKA, MeerKAT, HERA, PLATO and the Parker Solar Probe collaborations
- Extensive network of international collaborations (Europe, US, Mexico, Asia, South Africa)
- 17 permanent staff, 9 postdocs (of which 7 STFC funded) and 3 more postdocs arriving early 2020, and 22 PhD students

Astronomy Unit

Machine Learning

Theoretical Astrophysics

Big Data

- Skill set highly sought after in industry

Observational Astronomy

Astronomy Unit

Numerical simulations

- Recent PhDs and postdocs now work in AI, Data Science, Tech Startups, Quant roles

Astronomical Instrumentation

High Performance Computing

- Current in-house development of high precision spectrograph (future opportunity)

- World-leading expertise on **quantum field** and **string theories**, used for particle physics and gravity
- Extensive network of international collaborations (Europe, US, Asia)
- 14 academics, 4 postdocs and 20 PhD students

Astrophysics

Computational linguistics

Optics

CRST

Data science / machine learning

Condensed Matter

Collider experiments

Pure mathematics

- Wide variety of computational / analytical techniques.
- Allows us to make contact with many different fields...
- ... as well as industry!

From string theory to industry

- Coordinating node for the EU Innovative Training Network “SAGEX”.



SAGEX

Scattering Amplitudes:
from Geometry to Experiment

- 7 industrial partners, including **Maplesoft** and **Wolfram** (computer algebra software), **Danske Bank** and **DreamQuark** (financial modelling & AI), **Maersk Tankers** (logistics)
- Other recent collaborations include **Google** and **Microsoft**
- Our **skills** are highly portable, even when our **research knowledge** is not!

Particle Physics Research Centre

- World leading team of academics - working on the Large Hadron Collider (ATLAS, MoEDAL) at CERN, T2K and we will be joining DUNE in January
- Generic R&D programme targeting inventing new radiation detectors, applying cutting edge Data Science/Big Science methods to non-HEP domains for impact
- Global network with connections to all major particle physics labs: CERN, DESY, FNAL, J-PARC and KEK

Radiation detectors

Data acquisition

Structures

GRID computing

PPRC

Data science / machine learning

Condensed Matter

Collider experiments

Phenomenology

8 academics (2 hires expected in the next 6-9 month)

7 PDRAs (+ 3 just hired)

22 PhD students

2 Engineers + technicians

Network of data science contacts (includes Turing)

Network of material scientists and condensed matter physicists.

- State of the art semiconductor test facility
- One of the UK's leading GRID farms: in excess of 5000 job slots, 5 Pb of disk
- Key industry contacts include the Atomic Weapons Establishment and Micron Semiconductor
- Fostering links with other companies including 3M, Symetrica, etc. for semiconductor detector development, and a broader range of companies via our CDT

