

234. Members of the PPAN community undertake many public engagement activities to communicate their science as a matter of course. For example, 'Stargazing Live' is now an annual event, spearheaded by BBC programmes, to which a wide range of astronomy groups regularly contribute⁶⁶. Nuclear and Particle Physics Masterclasses are run annually by university groups to engage schoolchildren in research. PPAN scientists give talks to a variety of audiences, exhibit their science⁶⁷, blog, construct apps and use STFC small and large award and public engagement fellowship schemes to fund and explore innovative ways of engaging. These public engagement activities increase communication skills; skills that also enhance the effectiveness of scientific presentations, improve teaching ability and that are in demand by employers.
235. Besides engagement, societal impact includes the provision of national capability to protect our assets. The solar, heliospheric and space plasma communities have applied their expertise to space weather. Severe space weather is on the national risk register. In extreme cases it can lead to power blackouts, damage national grids and satellites in space. Members of the PPAN community advise government, work with the Met Office to address the national interest, and contribute to the emerging ESA Space Weather Programme.
236. We note that ResearchFish and Research Excellence Framework impact statements and data could be used to survey and evaluate the societal impact arising from these activities, given that the information is passed to these databases.

8. Future Reviews

237. In approving the Balance of Programme exercise at its April 2016 meeting, Science Board agreed that this exercise will take place on a three year cycle. The next review should be completed by December 2019. The following points are emphasised to ensure an effective exercise takes place in 2019.
238. The BoP exercise commenced during the summer 2016. This was found challenging by the Advisory Panels who had to respond to the BoP questions in September and needed to consult their communities. It is essential that any future exercise includes effective interaction with the Advisory Panel chairs throughout the process. The next BoP exercise should take into account the timing of future evaluations (e.g. so as to avoid major holidays or exam periods), and ensure that the duration of the exercise provides sufficient time for proper consultation and feedback at different stages of the review. It would be beneficial for these exercises to start during the spring period of the relevant year (Spring 2019).

⁶⁶ See e.g. <http://gostargazing.co.uk/2017/01/15/bbc-stargazing-live-2017/>

⁶⁷ For example, in the 2016 Royal Society Summer Science Exhibition 7 of 20 exhibits related to PPAN science areas or STFC facility work.

HPC – High Performance Computing. The use of parallel processing for running advanced application programmes efficiently, reliably and quickly

HTC - High Throughput Computing

Hyper-K – Hyper-Kamiokande detector. The detector consists of a megaton scale water tank and ultra-high sensitivity photosensors. Neutrinos are used to make observations of elementary particles and also the Sun and supernovae

IAB - Innovation Advisory Board

ISIS Neutron Source - world-leading centre for research in the physical and life sciences at the STFC Rutherford Appleton Laboratory near Oxford in the United Kingdom

ILC – International Linear Collider. The proposed ILC would complement the LHC at CERN and would consist of two linear accelerators to further our understanding of the nature of dark matter and dark energy

IoP - Institute of Physics

IPPP – Institute for Particle Physics Phenomenology. An international center for research in particle physics phenomenology – the bridge between theory and experiment in the study of the tiny building blocks of all matter in the universe and of the fundamental forces that operate between them

IPS - Innovations Partnership Scheme

IR - Infrared

ISOL-SRS – ISOL Beam Storage Ring Spectrometer. A proposed spectrometer which will aid in precision studies of the reactions and properties of unstable nuclei across the vast range of masses and isotopes produced by the ISOLDE radioactive beams facility at CERN

JAI – John Adams Institute. The John Adams Institute for Accelerator Science provides expertise, research, development and training in accelerator techniques, promoting advanced accelerator applications in science and technology

JAXA – Japan Aerospace Exploration Agency. Japan's national aerospace agency

JLab – Thomas Jefferson National Accelerator Facility (Jefferson Lab). One of 17 national laboratories funded by the US Department of Energy. Its mission is to conduct basic research of the atom's nucleus using the lab's accelerator

JUICE – Jupiter Icy Moon Explorer. A planned ESA spacecraft to visit the Jovian system, focussed on studying Jupiter's Galilean moons

JWST – James Webb Space Telescope. The successor to the Hubble Space Telescope, the JWST is a major space observatory currently under construction and scheduled to launch in 2018. It will operate at wavelengths ranging from 0.6-27µm

Kaon - Any of a group of four mesons (subatomic particles made of one quark and an antiparticle version of a quark)

Lattice QCD - A non-perturbative (see Perturbation Theory) approach to solving the QCD

LBNE - Long Baseline Neutrino Experiment. A high energy physics project, currently in its design phase that will combine the world's most intense long-distance neutrino beam and world's largest particle detector to reach unprecedented sensitivity and precision in measuring quantum mechanical mixing in the neutrino sector

LCLS - Linac Coherent Light Source

LHC – Large Hadron Collider. The world's largest and most powerful particle collider located at CERN

LHCb – Large Hadron Collider beauty. A study undertaken at CERN's LHC to investigate b and anti-b quark decays

LHCC – LHC Experiments Committee. A committee created to interact with LHC collaborators to discuss detector designs and to review the construction, installation and commissioning of the experiments

LHeC – Large Hadron Electron Collider. A project under design for combining the intense hadron beams of the LHC and possible future Circular Hadron Collider with a new electron accelerator at CERN

LIGO – Laser Interferometer Gravitational-Wave Observatory. A national facility for gravitational wave research comprising two interferometers, one in Washington and one in Louisiana. The detectors use laser interferometry to measure the ripples in space-time caused by passing gravitational waves from astrophysical sources

LINAC - Linear accelerator

LISA – Laser Interferometer Space Antenna (NASA/ESA). A proposed ESA mission designed to detect and accurately measure gravitational waves. It has been re-named to eLISA

LOFAR – Low Frequency Array. A radio telescope working at the lowest frequencies accessible from Earth. The array is currently under construction and, when completed, will be able to survey wide areas of sky simultaneously

LSST – Large Synoptic Survey Telescope. Currently under construction in Chile, the LSST will be used to image the sky at optical wavelengths and will be able to detect faint astronomical objects with unprecedented resolution

LT - Liverpool Telescope. A 2-metre fully robotic Ritchey–Chrétien telescope that observes autonomously

LZ – Lux Zeplin. Large Underground Xenon (LUX) ZonEd Proportional Scintillation in Liquid Noble gasses (ZEPLIN). A next generation dark matter experiment to search for Weakly Interacting Massive Particles (WIMPS)

M&O - Maintenance and Operation

MeerKat - Karoo Array Telescope. Radio telescope under construction in the Northern Cape of South Africa, will be an array of 64 interlinked receptors

MICE – Muon Ionization Cooling Experiment. A high-energy physics experiment designed to demonstrate ionisation cooling of muons

MicroBooNE - a liquid argon time projection chamber (LArTPC) at Fermilab in Batavia, IL

MINOS – Main Injector Neutrino Oscillation Search. A long baseline experiment designed to study neutrino oscillations in a controlled accelerator experiment and to measure the oscillation parameters

MOONS – Multi Object Optical and Near-infrared Spectrograph. A large field, multi object instrument proposed for the VLT, which will conduct research into galactic structure and galaxy evolution up to the epoch of re-ionisation

MOS – Multi Object Spectrograph. Used to obtain the spectra of many objects simultaneously

Mu2e/Mu3e – Muon to Electron conversion experiments. Two experiments designed to observe muon-to-electron conversion which will better our understanding of why particles in the same family decay from heavy to lighter and more stable mass states

Muon – One of the fundamental particles of nature, essentially a short-lived heavier version of the electron

NA62 - An experiment focused on precision tests of the Standard Model by studies of rare decays of charged kaons

NASA - National Aeronautics and Space Administration

nEDM – Neutron Electric Dipole Moment. A measure for the distribution of positive and negative charge inside the neutron

NGTS – Next-Generation Transit Survey. A wide-field photometric survey designed to discover transiting exoplanets

NOvA - NuMI Off-Axis ν_e Appearance. An experiment designed to detect neutrinos in Fermilab's NuMI beam

NP - Nuclear Physics

NPGP - Nuclear Physics Grants Panel

NuSTAR – Nuclear Structure, Astrophysics and Reactions. A collaboration with the aim of exploiting the beams of short-lived radioactive species to study how the properties of nuclei and nuclear matter vary over a wide range of properties

NuSTORM – Neutrinos from Stored Muons. A proposed storage ring facility designed to provide measurements of neutrino and antineutrino nucleus scattering cross sections

PA - Particle Astrophysics

PAAP - Particle Astrophysics Advisory Panel. To provide a link between Science Board and the particle astrophysics community, and represent the needs of the community to STFC

PB – Petabyte

PD- Programmes Directorate

PDFs - Parton Distribution Functions

PDRA - Postdoctoral Research Assistant

PhenoGrid - LCG virtual organisation dedicated to developing the phenomenological tools necessary to interpret the events produced by the LHC

PINGU - Precision IceCube Next Generation Upgrade

PP - Particle Physics

PPAN - Particle Physics, Astronomy & Nuclear Physics

PPD - Particle Physics Department at RAL

PPE - Particle Physics Experimental

PPGP - Particle Physics Grants Panel. Responsible for assessing and making recommendations to the STFC Executive on research grant applications in particle physics covering scientific exploitation of facilities and projects, 'blue skies' technology research, theory, modelling, data handling and HPC access

PPRP - Projects Peer Review Panel. Responsible for the assessment of projects that are considered to have significant scientific priority in particle physics, nuclear physics, astronomy and particle astrophysics

PPT - Particle Physics Theoretical

PRACE - Partnership for Advanced Computing in Europe. 25 member countries creating a pan-European supercomputing infrastructure, providing access to computing and data management resources and services for large-scale scientific and engineering applications.

PRD - Project research & development grants

PSI - Paul Scherrer Institute, Switzerland

QCD – Quantum Chromodynamics. A theory of the strong interaction.

QFT - Quantum field theory

RAC - Resource Allocation Committee

RAL - Rutherford Appleton Laboratory. One of the national scientific research laboratories in the UK operated by the Science and Technology Facilities Council

RCUK - Research Councils UK

ResearchFish –service for the collection and reporting of outcomes to enable research impact tracking.

RIKEN – Institute of Physical and Chemical Research. A large research institute in Japan which conducts research in many areas of science including physics, chemistry, biology, engineering and medical science

RRB - Resources Review Boards

SBND – Short Baseline Near Detector. One of three liquid argon neutrino detectors at Fermilab as part of the Short-Baseline Neutrino Program which will perform searches for neutrino oscillations

SEAB - Skills and Engagement Advisory Board

SHiP – Search for Hidden Particles. A new general purposed fixed target facility located at CERN used to search for hidden particles such as very weakly interacting long lived particles

Solar Orbiter - a planned Sun-observing satellite, under development by the ESA

SKA – Square Kilometre Array. A radio interferometer currently under construction in Australia and South Africa which will address key topics in astrophysics, fundamental physics, cosmology and particle astrophysics

SNO – Sudbury Neutrino Observatory. Decommissioned in 2006, the SNO was an underground neutrino observatory located in Sudbury, Canada

SNO+ - Sudbury Neutrino Observatory +. A new kilo-tonne scale liquid scintillator detector that will study neutrinos

SoLiD - Short baseline Oscillation search with Lithium-6 Detector

SPECT/CT Scan - Single Photon Emission Computed Tomography / Computed Tomography

SSAP - Solar System Advisory Panel

STA - Scintillator Tracking Array

STFC – Science and Technology Facilities Council. A UK government body that carries out research in science and engineering and funds research in particle physics, nuclear physics, space science and astronomy

SuperNEMO – Super Neutrino Ettore Majorana Observatory Demonstrator. A next generation experiment to search for Neutrinoless Double Beta Decay, the only way to investigate the fundamental nature of the neutrino

SUSY - supersymmetry

T2K – Tokai to Kamioka (collaboration). A long-baseline neutrino experiment in Japan to study neutrino oscillations

TDRs - Technical Design Reports

THOR - Turbulence Heating Observer

UKATC – UK Astronomy Technology Centre. The national centre for astronomical technology and part of the STFC. UK ATC designs and builds instruments for many of the world's major telescopes and carries out observational and theoretical research in astronomy and astrophysics

UKMHD - Consortium Super Computing facilities

UK FEL - UK Free Electron Laser community

UKSA – UK Space Agency. UKSA are responsible for all strategic decisions on the UK civil space programme

UKT0 - UK-T0 is an evolving self-organised collaboration of the STFC science and facilities communities who use compute resources. The collaboration was founded through computing work being an overlapping and shared environment, with many interdependencies between all STFC areas. UK-T0 promotes working together, sharing of resources, avoidance of duplication, and shared expertise and support. It also serves as a hub to aggregate computing requirements across STFC.

VIRGO - Consortium for Cosmological Supercomputer Simulations

VLA - Very Large Array

VLT – Very Large Telescope. A telescope facility operated by ESO in the Atacama Desert in Chile. It comprises four optical telescopes used together to achieve very high angular resolution

WEAVE – WHT Enhanced Area Velocity Explorer. A concept for a new wide-field spectroscopy facility for the 4.2-m Herschel Telescope

WIMPs - Weakly Interacting Massive Particles

XFEL – European X-ray Free Electron Laser. A subterranean X-ray research laser facility currently under construction which is planned to start operation in 2017

XMM-Newton – X-ray Multi-Mirror Mission – Newton. An ESA space mission which comprises three X-ray telescopes used to conduct research including the study of black holes and the origins of the Universe