Particle Physics Advisory Panel

Report to 2013 Town Meeting

Philip Burrows

John Adams Institute for Accelerator Science

Oxford University

Outline

- **Context and remit**
- **PPAP membership**
- **2012/13 activities**
- **Looking ahead**

Advisory Panels set up 2009

‘Five standing advisory panels will report to STFC’s Science Committee for Particle Physics, Astronomy and Nuclear Physics:

The panels will cover the areas of:

- **Particle Physics (PPAP)**
- **Nuclear Physics (NPAP)**
- **Particle Astrophysics (PAAP)**
- **Near Universe (NUAP)**
- **Far Universe (FUAP)’**

Consultation and ‘reset’ in 2012 …

Terms of Reference (2012)

Maintain an overview of activities within the area

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The PPAP 2012-13

Philip Burrows (Oxford) ***chair***

Cinzia Da Via (Manchester)

Nigel Glover (Durham)

Paul Newman (Birmingham)

Claire Shepherd-Themistocleous (RAL) ***deputy chair***

Mark Thomson (Cambridge)

Jonas Rademacker (Bristol)

Bill Spence (QMUL)

Matthew Wing (UCL)

Rachel Reynolds / Sarah Verth (STFC)

Working Together

- Particle physics members of PPAN / SB
- Experiment and Theory Grants Panels
- IoP HEPP + PAB Groups
- PA, NP, Astr, Sol Advisory Panels
- Grant holders + principal investigators
- PP Action Group

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- All of us!

PPAP activities

- Meet every 1-2 months by phone (+ in person)
- Organise annual community town meeting
- Prepare ‘roadmap’ reports
- Organise ‘forum’ of group + project PIs + Executive
- Make submissions to consultations
- Meet with PPAN / Science Board and Executive

Community town meetings

2009, 2010, 2011, 2012 (Birmingham)

100-200 community members attend

PPAP Community meeting in preparation for PP roadmap drafting

from **Monday 17 September 2012 (10:30)**
to **Tuesday 18 September 2012 (17:30)**
chaired by: ***Phil Burrows***

Description: Birmingham University Physics Department:
http://www.ep.ph.bham.ac.uk/index.php?page=general/travel/index

Physics West Lecture Theatre W117

Monday 17 September 2012 | Tuesday 18 September 2012 |

Monday 17 September 2012 top

10:30	Coffee	
11:00	Introduction to programmatic review and discussion (30') (Slides)	Jon Butterworth UCL)
11:30->*13:15*	**Energy Frontier**	
11:30	Report back from Krakow workshop and discussion (30') (Slides)	Dan Tovey (Sheffield)
12:00	CMS outlook and discussion (30') (Slides)	Dave Newbold (Bristol)
12:30	ATLAS outlook and discussion (30') (Slides)	Monica D'Onofrio (Liverpool)
13:00	High Performance Computing (15') (Slides)	Pete Clarke (Edinburgh)
13:15	Lunch	
14:00->*16:00*	**Energy Frontier**	
14:00	Future lepton colliders and discussion (30') (Slides)	Lyn Evans (CERN)
14:30	LHeC and discussion (30') (Slides)	Max Klein (Liverpool)
15:00	Discussion on Energy Frontier (1h00')	
16:00	Tea	
16:30->*18:00*	**Theory**	
16:30	Overview (15') (Slides)	Simon Hands (Swansea)
16:45	Lattice (15') (Slides)	Christine Davies (Glasgow)
17:00	Formal Theory and Cosmology (15') (Slides)	David Tong (Cambridge)
17:15	Phenomenology (15') (Slides)	Valya Khoze (Durham)
17:30	Discussion on Theory (30')	

Main activities in 2012/13

Input to European PP Strategy Update (July)

PIs / Executive forum

Main activities in 2012/13

Input to European PP Strategy Update (July)

PIs / Executive forum

UK input to European Particle Physics Strategy Update

STFC Particle Physics Advisory Panel:

P.N. Burrows, C. Da Via, E.W.N. Glover, P. Newman, J. Rademacker,

C. Shepherd-Themistocleous, W. Spence, M. Thomson, M. Wing

(on behalf of the UK particle physics community)

30/7/12

Introduction

The UK Particle Physics Advisory Panel (PPAP) is charged with providing input from the UK particle physics community to the Science and Technology Facilities Council (STFC) for use in its strategic planning processes. In 2009 the PPAP produced a UK particle physics 'roadmap' [1] that has recently been updated [2]. Based on the PPAP roadmap, the approved UK particle physics programme, and the current interests of the UK community, we provide here a short UK perspective for consideration by the CERN Council Strategy Group as it prepares an update to the European particle physics strategy.

1. Energy frontier physics

The LHC is the world's flagship energy frontier exploration facility. It is performing spectacularly well and the discovery of a new boson consistent with being the (Standard Model) Higgs boson has just been announced.

The UK has made major investments in the ATLAS and CMS general purpose detectors (GPDs). A large number of UK particle physicists are committed to the operation and scientific

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Input to European PP Strategy Update (July)

PIs / Executive forum

Community town meeting (Sept)

Particle Physics Roadmap 2012 (Oct)

PIs forum

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Particle Physics Roadmap 2012 (Oct)

PIs forum

Presentation to PPAN (Nov)

Input to PPAN on future project resources and timescales (Jan)

Main activities in 2012/13

Input to European PP Strategy Update (July)

PIs / Executive forum

Community town meeting (Sept)

Particle Physics Roadmap 2012 (Oct)

PIs forum

Presentation to PPAN (Nov)

Input to PPAN on future project resources and timescales (Jan)

Input to BIS / Cabinet Office triennial review of research councils (Feb)

Particle Physics Roadmap 2012

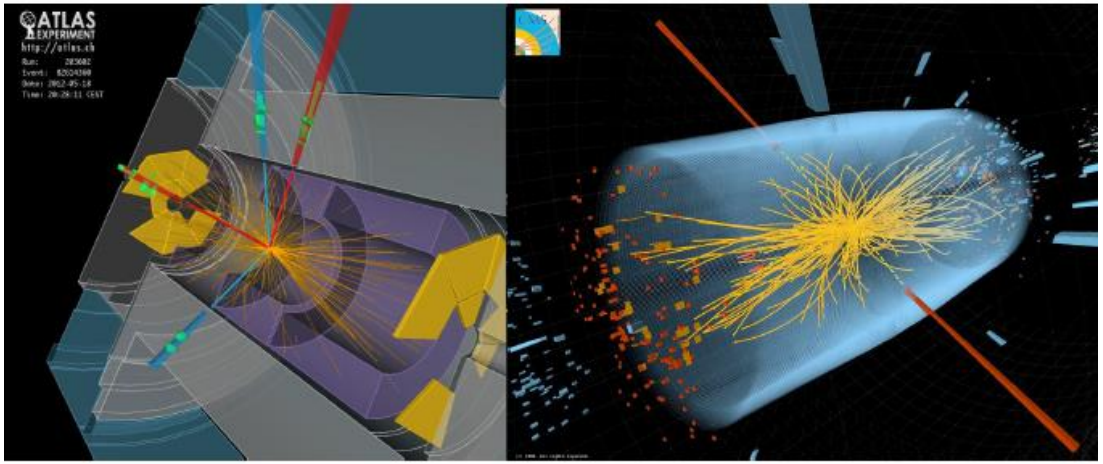
The UK Particle Physics Roadmap

Particle Physics Advisory Panel:

P. N. Burrows, C. Da Via, E. W. N. Glover, P.R. Newman, J. Rademacker,

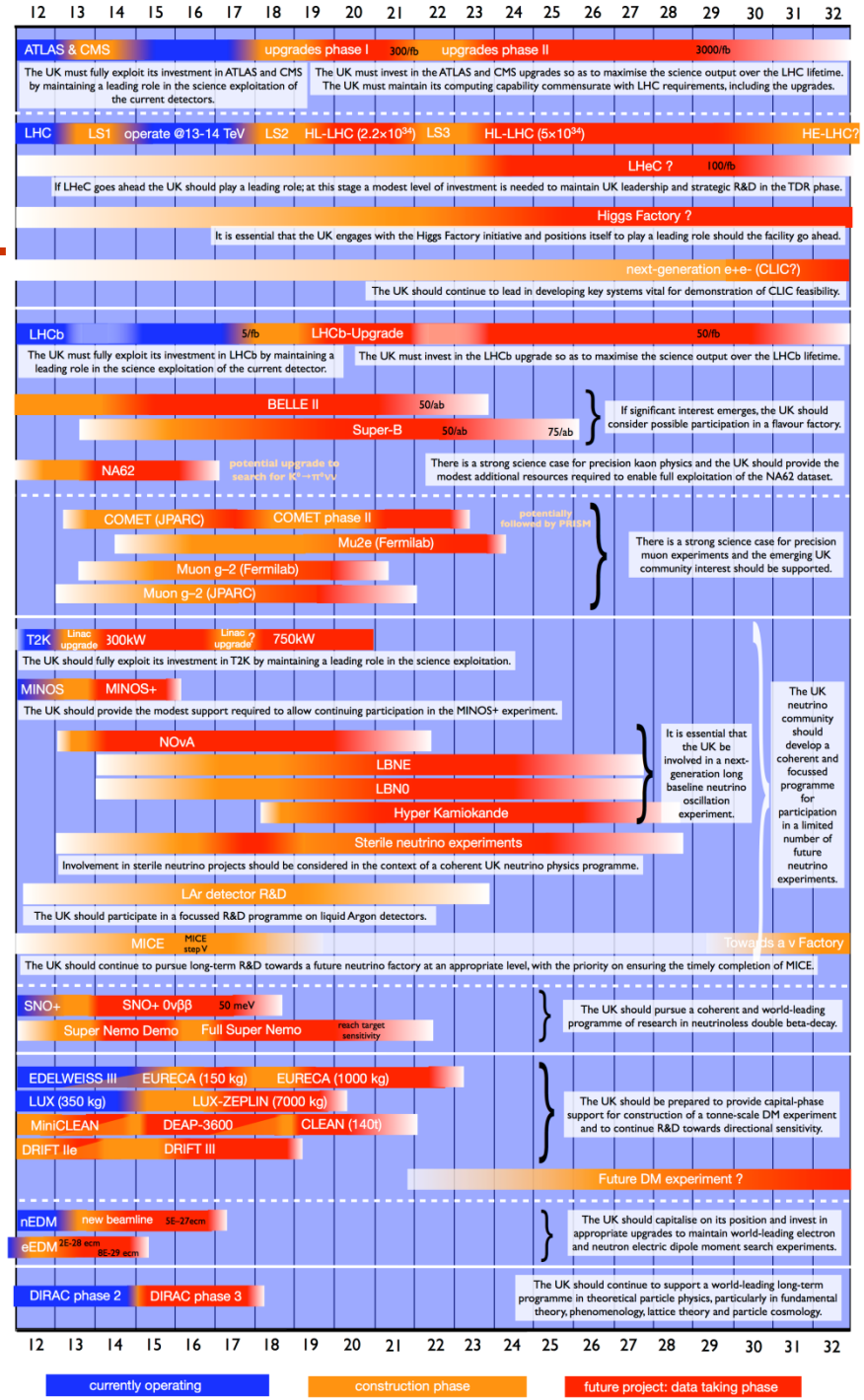
C. Shepherd-Themistocleous, W.J. Spence, M. A. Thomson and M. Wing

7/11/12



1. Introduction
2. Fundamental questions
3. Facilities
4. Roadmap
5. Technology

Roadmap chart

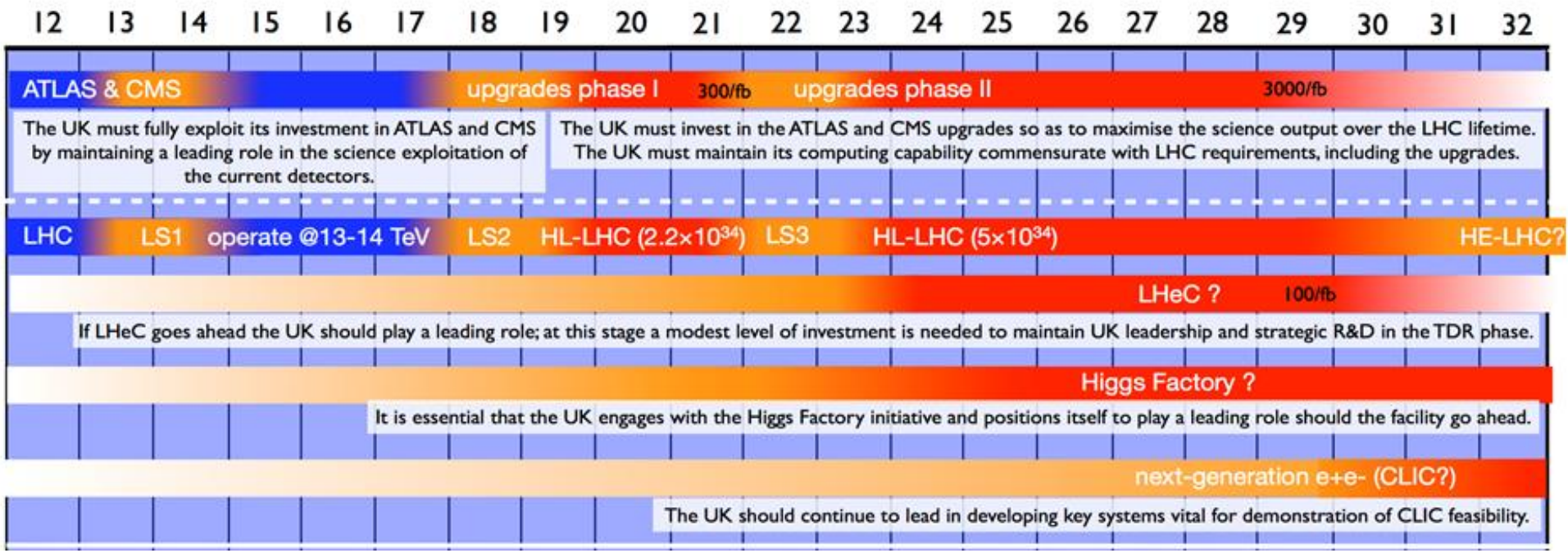


- **What are the basic building blocks of the Universe?**
- **Can the forces between particles be understood in a unified framework?**
- **How does gravity fit in?**
- **What unknown properties of these particles and forces drove the evolution of the Universe from the Big Bang to its present state?**
- **What is the origin of the matter/antimatter asymmetry?**

Recommended programme

	Exploitation phase	Upgrade phase	Medium-term construction (operation within c. 10 years)	Design-stage projects; construction decision/start within c. 5 years	R&D for longer-term future projects
Energy frontier	**ATLAS+CMS**	***ATLAS+CMS phase 1 upgrades***	***ATLAS+CMS phase 2 upgrades (HL-LHC)***	*Higgs Factory* *LHeC*	*HE-LHC* *CLIC*
Flavour frontier	**LHCb** NA62	***LHCb upgrade***	*Precision lepton flavour experiment*		
Neutrino frontier	**T2K** MINOS+ SNO+		***Neutrinoless double beta decay experiment***	***Next-generation long baseline experiment*** *LAr detector*	Neutrino factory
Non-accelerator frontier	**EDM searches**		***Dark matter search experiment***		

Energy frontier



How do elementary particles acquire mass? Is the SM Higgs boson sufficient, or are new laws of physics required?

What is the new physics that solves the problems of the SM? Are there new particles or new principles?

Are there as-yet undiscovered symmetries of nature such as supersymmetry (SUSY)?

Are leptons and quarks truly distinct, or are they separate manifestations of a single type of matter?

Are there extra dimensions of space or time?

Can we understand the phenomena produced by strongly interacting systems?

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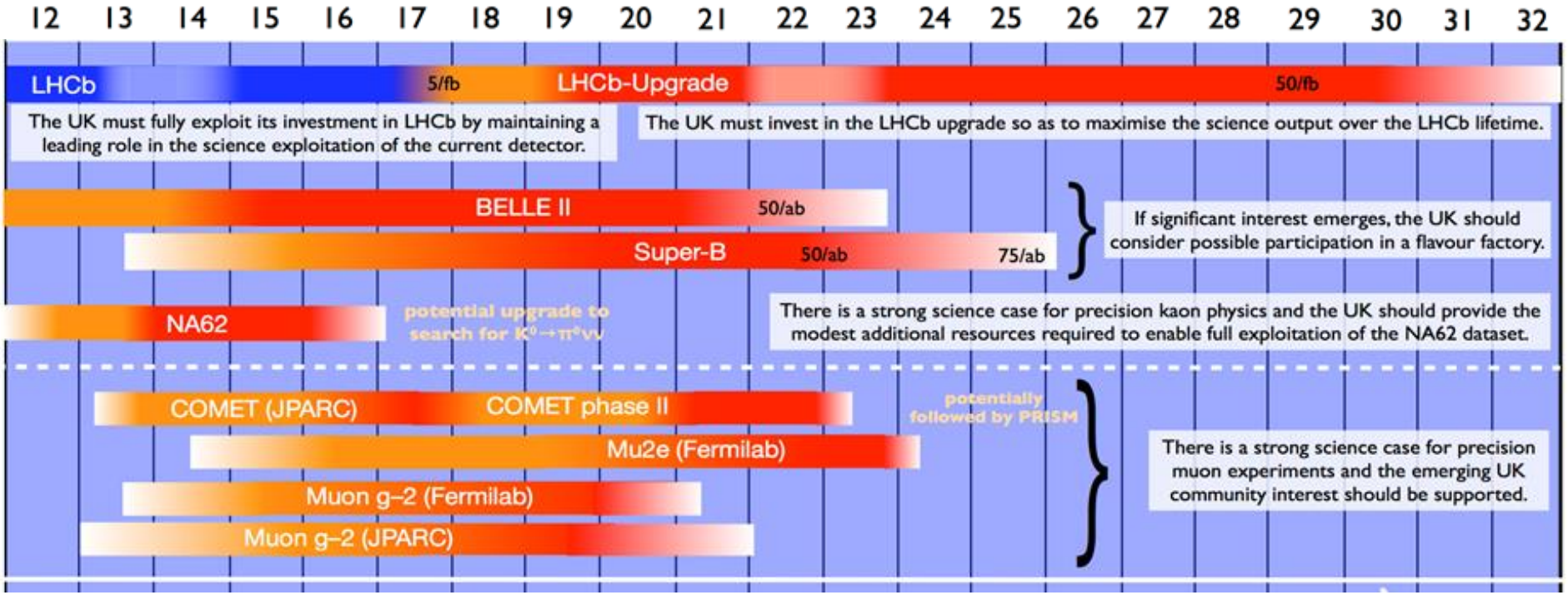
Flavour frontier



How many generations of elementary particles are there? What principle determines this number?

Does new physics introduce new sources of flavour- and CP-violation beyond those of the SM quark sector?

If not, what principle explains the uniqueness of the SM couplings?

Is charged lepton flavour conservation violated? If so, what new physics causes it?

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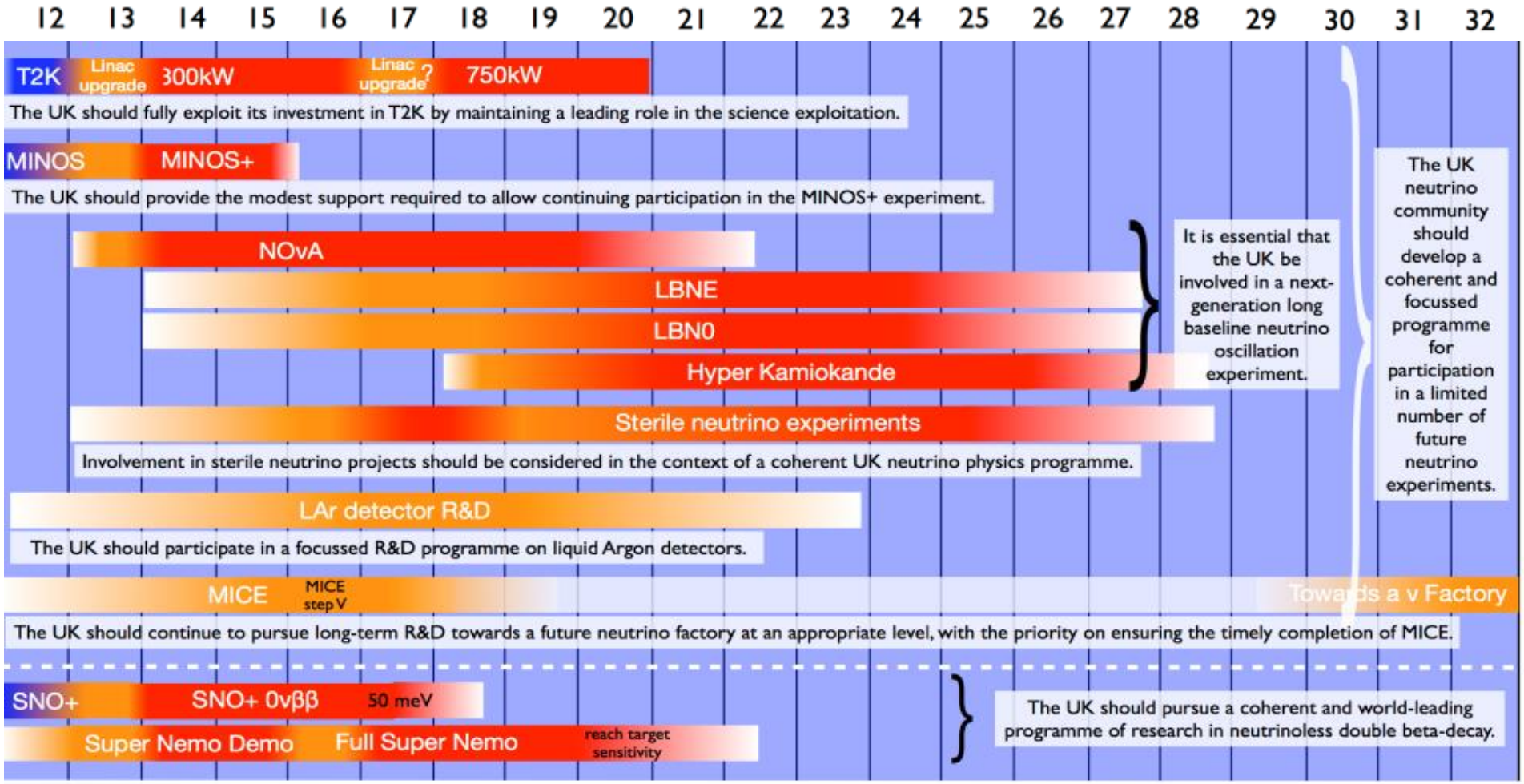
Neutrino frontier



What are the masses and properties of neutrinos and what role did they play in the evolution of the Universe?

Is the neutrino its own antiparticle?

Is CP violation realised in the neutrino sector? How are neutrinos connected to the matter-antimatter asymmetry?

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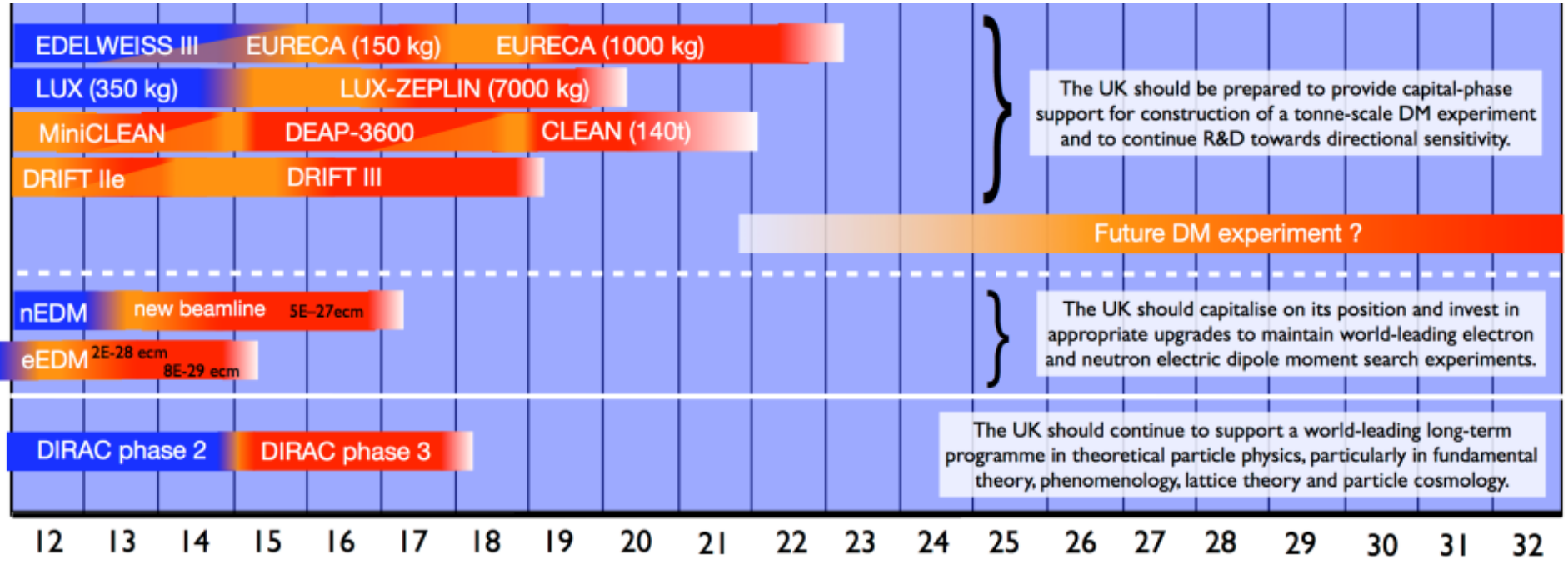
Non-accelerator frontier



What is the Dark Matter that makes up about one quarter of the contents of the Universe?

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Do contact us!

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http://www.stfc.ac.uk/About+STFC/39536.aspx

Looking Ahead

Despite tough financial environment, exciting times with significant scientific opportunities

Programmatic review outcome (PPAN) ~ May,
officially adopted (BIS) ~ October

Community meeting 2013?

Your PPAP needs you!

New Members Needed

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