# Strategic thinking

Europe and the US, with their international partners, are planning their way ahead in particle physics.

Particle physics is big science: big facilities, big collaborations, big bills — and big plans. As the rush of excitement over the discovery of a Higgs boson ebbs away, particle physicists are busy discussing "what next?".

Of course, there are many years of data still to be taken at CERN's Large Hadron Collider (LHC), which will spring back into action in 2015 after an extended period of maintenance and upgrades. As noted in the recent update to the European Strategy for Particle Physics[1], the Higgs discovery is only "the start of a major programme of work", and full exploitation of the LHC up to 2030 is listed as the top priority for the European particle physics community. That programme will also include a substantial upgrade in the LHC's 'luminosity', dramatically increasing the amount of data that can be collected.

The European Strategy was originally formulated[2] in 2006, and, following the "giant leap" of the Higgs discovery, the update is welcome. Throughout last year, a group of physicists representing national laboratories, CERN, each of CERN's member states and also associate members and observers (such as India, Japan and the USA) took part in a series of meetings to discuss a revised strategy, including an open symposium held in Kraków, Poland. The process culminated in the formal adoption of the strategy at the end of May this year, with the recommendation that further updates are made at intervals of about five years.

Next on the list of priorities after the exploitation of the LHC is to plan for the LHC's successor: by the time of the next update "Europe needs to be in a position to propose an ambitious post-LHC accelerator project at CERN". The strong scientific case for an electron–positron collider is acknowledged — as is the desire of Japan to host that machine. This project has already advanced to the stage that a technical design report, for the 'International Linear Collider', has been published[3]. Europe would look to participate.

It's not all about huge colliders: support for a diverse programme in theoretical physics, for detector research and development in astroparticle physics, for experiments in national laboratories with "unique reach" — are all advocated. And progress that has been made in neutrino physics, particularly in investigating CP violation in the neutrino sector, prompts the recommendation that Europe should "explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan".

All of which will be food for thought for the US community of particle physicists, who are themselves engaged in their own future-strategy planning, the so-called Snowmass process[4]. A series of 15 workshops is set to end on 6 August 2013 with 'Snowmass on the Mississippi', in Minneapolis; findings will be reported the following week at the meeting[5] of the American Physical Society Division of Particles and Fields, and a formal report issued at the end of September.

The Snowmass workshops have been open for all to attend, including physicists from outside the US, in recognition of the probable global implications of the decided strategy. High-energy particle physics is no longer the business of a single nation, or even a single continent. Indeed, the LHC project has been a milestone in the establishment of truly worldwide collaboration, and future large-scale projects will almost certainly involve international partnership at the outset. The European Strategy update calls it "the globalization of the field", with no exaggeration. It also cites the success of the LHC as "proof of the effectiveness of the European organizational model for particle physics, founded on sustained long-term commitment". There's no arguing with that, and it's likely that a significant outcome of this latest round of strategizing will be a road map towards a world programme of big science — and the strongest possible position from which to secure the funding for it.

Because there's no shortage of ideas: from the 'big questions' posted[6] by Snowmass participants, to experimental proposals, such as the electron–proton collider discussed by Paul Newman and Anna Stasto in their Commentary on page 448. The Higgs is only the start. ❐

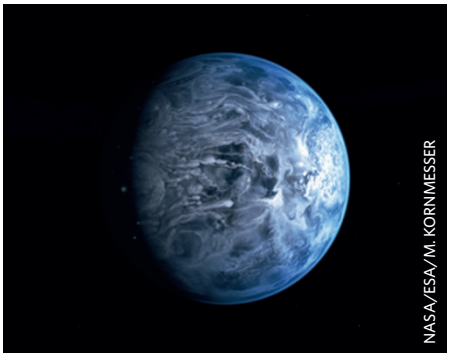
### References


1. http://go.nature.com/kalrX4
2. Cashmore, R. *Nature Phys.* **2,** 572–574 (2006).
3. *Nature Phys.* **9,** 1 (2013).
4. www.snowmass2013.org
5. http://scipp.ucsc.edu/dpf2013
6. http://go.nature.com/qBYs1o


# Hurray for Hubble

The remarkable space telescope reveals true colours — and a new moon.

In orbit since 1990, the Hubble Space Telescope has delivered some of the most detailed visible-light images of the Universe — such stunning images that they are star-players in the Royal Greenwich Observatory's exhibition *Visions of the Universe* (page 452), which is even proving a hit with mainstream art critics (http://go.nature.com/p1usot). It is undoubtedly a huge asset to NASA in communicating the wonder of astronomy, but, four years since its last service by space-shuttle astronauts, it's still delivering great science too.



NASA/ESA/M. KORNMESSER

A rummage through earlier Hubble data last month turned up a new moon for Neptune — its fourteenth, and the smallest so far. Also announced was the first detection of the colour of an exoplanet: HD 189733 b is about 19 parsecs away in the Vulpecula constellation, and it's blue.

With its successor, the James Webb Space Telescope, scheduled for launch in 2018, Hubble will operate until at least 2014, perhaps even 2020. But its photographic memories will linger on. ❐