DESIGN STUDIES

Collaboration meets for the first FCC week

As many as 340 physicists, engineers, science managers and journalists gathered in Washington DC for the first annual meeting of the global Future Circular Collider (FCC) study (*CERN Courier* April 2014 p16). The FCC week covered all aspects of the study – designs of 100-km hadron and lepton colliders, infrastructures, technology R&D, experiments and physics.

The meeting began with an exciting presentation by US congressman Bill Foster, who recalled the history of the LHC as well as the former design studies for a Very Large Hadron Collider (*CERN Courier* April 1999 p18). A special session on Thursday was devoted to the experience with the US LHC Accelerator Research Program (LARP), to the US particle-physics strategy, and US R&D activities in high-field magnets and superconducting RF. A well-attended industrial exhibition and a complementary "industry fast-track" session were focused on Nb_3Sn and high-temperature superconductor development.

James Siegrist from the US Department of Energy (DOE) pointed the way for aligning the high-field magnet R&D efforts at the four leading US magnet laboratories

Congressman Bill Foster told the audience: "never be shy in standing up for the unique nature of your field and never be afraid of big numbers". (Image credit: Bob Palmer, BNL.)

(Brookhaven, Fermilab, Berkeley Lab and the National High Magnetic Field Laboratory) with the goals of the FCC study. An implementation plan for joint magnet R&D will be composed in the near future. Discussions with further US institutes and universities are ongoing, and within the coming months several other DOE laboratories should join the FCC collaboration. A first US demonstrator magnet could be ready as early as 2016.

A total of 51 institutes have joined the FCC collaboration since February 2014, and the FCC study has been recognized by the European Commission (EC). Through the EuroCirCol project within the HORIZON2020 programme, the EC will fund R&D by 16 beneficiaries – including KEK in Japan – on the core components of the hadron collider. The four key themes addressed by EuroCirCol are the FCC-hh arc design (led by CEA Saclay), the interaction-region design (John Adams Institute), the cryo-beam-vacuum system (CELLS consortium), and the high-field magnet design (CERN). On the last day of the FCC week, the first meeting of the FCC International Collaboration was held. Leonid Rivkin was confirmed as chair of the board, with a mandate consistent with the production of the Conceptual Design Report, that is, to the end of 2018.

The next FCC Week will be held in Rome on 11–15 April 2016.

● The FCC Week in Washington was jointly organized by CERN and the US DOE, with support from the IEEE Council of Superconductivity. More than a third of the participants (120) came from the US. CERN (93), Germany (20), China (16), UK (16), Italy (12), France (11), Russia (11), Japan (10), Switzerland (10) and Spain (6) were also strongly represented. For further information, visit cern.ch/fccw2015.

NUCLEAR PHYSICS

First measurement of ionization potential casts light on 'last' actinide

The quest for new heavy chemical elements is the subject of intense research, as the synthesis and identification of these new elements fill up empty boxes in the familiar Periodic Table. The measurement of their properties for a proper classification in the table has proved challenging, because the isotopes of these elements are short-lived and new methods must be devised to cope with synthesis rates that yield only one atom at a time. Now, an international team led by researchers from the Japanese Atomic Energy Agency (JAEA) in Tokai has developed an elegant experimental strategy to measure the first ionization potential of the heaviest actinide, lawrencium (atomic number, $Z = 103$).

Using a new surface ion source (figure 1) and a mass-separated beam, the team's measurement of 4.96±0.08 eV – published recently in *Nature* (Sato *et al.* 2015) – agrees perfectly with state-of-the-art quantum chemical calculations that include relativistic effects, which play an increasingly important role in this region of the Periodic Table. The result confirms the extremely low binding energy of the outermost valence electron in this element, therefore confirming its position as the last element in the actinide series. This is in line with the concept of heavier homologues of the lanthanide rare earths, which was introduced by Glenn Seaborg in the 1940s.

In the investigations at JAEA the researchers have exploited the isotope-separation online (ISOL) technique, which has been used for nuclear-physics studies at CERN's ISOLDE facility since the 1960s (*CERN Courier* December 2004 p16). The technique has now been adapted to perform ionization studies with the one-atom-at-a-time rates that are accessible

Fig. 1. The newly developed surface ion source (the grey tantalum tube in the centre of the photo surrounded by two heating filaments) installed in the JAEA-ISOL system at the JAEA Tandem accelerator. (Image credit: JAEA.)

for studies of lawrencium. A new surface-ion source was developed and calibrated with a series of lanthanide isotopes of known ionization potentials. The ionization probability of the mass-separated ▷