Results from CERN presented at ICHEP

Geneva 7 July 2014. Speaking at press conference held during the 37th International Conference on High Energy Physics, ICHEP, in Valencia, Spain this morning CERN[1] Director General Rolf Heuer gave a resume of results from CERN that are being presented. The conference, which began last Thursday with three days of parallel sessions, now moves on to plenary sessions until Wednesday, summing up the current state of the art in the field. The plenary sessions will be webcast (http://ichep2014.es/content/webcasting).

"Two years on from the last ICHEP conference, during which the discovery of the messenger of the Brout-Englert-Higgs mechanism, a Higgs boson, was announced, this topic is still a strong focus of the presentations from CERN," said Professor Heuer. *"But for me, the main message I'm taking away from this conference is that there's a lot at stake for the LHC's second run starting next year, and the experiments are all ready to exploit the full potential that higher-energy running brings."*

All four LHC experiments presented new results from the LHC's first run, which concluded in 2013. For ATLAS and CMS, the run-1 Brout-Englert-Higgs (BEH) analyses are reaching a conclusion. All show that the Higgs particle behaves in a way consistent with the Standard Model: the theory that accounts for the behaviour of fundamental particles of matter and the interactions at work between them. Nevertheless, based on the run-1 sample, the BEH analyses do not rule out new physics, and with a much higher Higgs production rate at higher energy, run-2 BEH physics holds much promise. The Standard Model describes the behaviour of what we consider to be ordinary matter to great precision, but we know that ordinary matter makes up just about 5% of the total matter and energy of the Universe: there's much more to be discovered in the so-called dark Universe of Dark Matter and Energy.

One possible candidate for Dark Matter is supersymmetry, a theory that predicts a range of so-far unobserved particles that could make up the 27% of the Universe composed of Dark Matter. Through run-1, the LHC experiments have ruled out a number of supersymmetric models, but more possibilities will be within reach in run-2.

Spearheaded by the ALICE experiment, which is dedicated to exploring Quark Gluon Plasma (QGP), the hot-dense state of matter that would have existed just after the Big Bang, all the LHC experiments have delivered new insights into this exotic form of matter. And LHCb, the experiment that specialises in measuring short-lived particles with great precision, presented a range of results showing

[1] CERN, the European Organization for Nuclear Research, is the world's leading laboratory for particle physics. It has its headquarters in Geneva. At present, its Member States are Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Israel, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. Romania is a Candidate for Accession. Serbia is an Associate Member in the pre-stage to Membership. India, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and UNESCO have Observer Status.

the power of the LHCb detector in contributing to a wide range of topics, from QGP to matter-antimatter asymmetry.

After 18 months of maintenance and upgrading, the CERN accelerator complex is now starting up for physics. Research programmes at all the accelerators with the exception of the LHC will be underway in 2014, with the LHC joining in spring 2015.

"The LHC is a focal point for particle physics research at the high-energy frontier," said Heuer. *"It forms part of globally coordinated strategy for the field, with plans in Europe, North America and Japan converging to ensure strength in the field in all regions."*

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