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Editorial

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Editorial of the 13th International Conference on B-Physics at Hadron Machines - Beauty2011

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This edition of the Proceedings of Science contains papers presented at the 13th International Conference on B-Physics at Hadron Machines (Beauty 2011) which was held at the Felix Meritis building in the historic centre of Amsterdam from 4th–8th April 2011. It was hosted by Nikhef, the National Institute for Subatomic Physics of the Netherlands, and attracted about 100 participants, including world experts from Europe, America and Asia, and had 60 invited talks. This was the latest in a series of meetings dating back to the 1993 conference held at Liblice Castle in the Czech Republic.

Traditionally, the Beauty conference series has a strong focus on studies of B mesons at hadron machines. In the previous decade, this field was the domain of the Tevatron $p\bar{p}$ collider at Fermilab with the CDF and DØ experiments. The e^+e^- B factories at SLAC and KEK with the BaBar and Belle detectors first established CP violation in the B-meson system, but the Tevatron experiments have extended the measurements into the B_s-meson sector, which up to now had been poorly explored. These studies have shown that the Cabibbo–Kobayashi–Maskawa matrix is the dominant source of flavour and CP violation, in accordance with the Standard Model.

However, there is evidence that the Standard Model is not complete and recent B_s-decay studies by the CDF and DØ collaborations give a hint of new sources of CP violation in a quantum mechanical phenomenon, B_s–$\bar{B}_s$ mixing, although the uncertainties are still too large to draw definite conclusions. In specific scenarios for physics beyond the Standard Model (such as supersymmetry and models with extra Z' bosons), it is actually possible to accommodate such New Physics effects.

The highlights of Beauty 2011 were first physics results from the LHC experiments. It was very impressive to see the wealth and high quality of the reported data. Particularly exciting was the presentation of the first analysis of the CP-violating observables of the $B_s \to J/\psi\phi$ decay by LHCb. Although the experimental errors are still large, it is intriguing that the early data do not seem to disfavour a picture similar to the CDF and DØ results mentioned above. Fortunately, LHCb should be able to reduce the uncertainties significantly within a year, with the prospects of revealing new phenomena in B_s–$\bar{B}_s$ mixing.

Another exciting decay to search for New Physics is the rare decay $B_s \to \mu^+\mu^-$, which originates from quantum loop effects in the Standard Model. However, new particles running in the loops or even contributing at the tree level may significantly enhance the decay rate. So far, this decay has been the domain of the CDF and DØ experiments, putting upper bounds on the branching ratio that are still about one order of magnitude above the Standard-Model prediction. Also here LHCb has now entered the stage, presenting a first upper bound in the ball-park of the Tevatron results. The LHCb constraints, and soon to follow ATLAS and CMS, will quickly become stronger and it will be interesting to see whether eventually a signal for $B_s \to \mu^+\mu^-$ will emerge significantly different from the Standard-Model predictions.

In addition to these key channels facilitating the search of New Physics in B decays in the early phase of the LHC era, the conference covered a wide spectrum of other topics. Results on heavy-flavour production were presented with the first LHC data collected at the ATLAS, CMS, LHCb and ALICE experiments. Another interesting topic was charm physics, with results from BES III, CDF and first LHCb analyses. A summary was given of B-factory results on the measurement of CP violation and the unitarity triangle parameters. The status of lepton flavour violation and models of physics beyond the Standard Model was also presented. Moreover, also the potential of upcoming B-physics experiments, SuperB, SuperKEKB and the LHCb upgrade, was discussed.

The many experimental presentations were complemented by theoretical review talks, and the excellent presentations all generated lively discussion.

The physics discussions continued also in an informal way during a tour on historic boats through the canals of Amsterdam, with people enjoying the spectacular weather, and later a visit to the Hermitage museum where the conference dinner was held.

Beauty 2011 has shown that we live in exciting times for B physics, with still a lot of activity at the Tevatron and the first physics results from the LHC. It will be interesting to see whether already the data collected at LHCb and the general purpose detectors this year will establish New Physics in the B-meson sector. Flavour physics is moving towards new frontiers and is a fascinating part of the LHC adventure. Correlations between various flavour-physics observables and the interplay with the direct searches for new particles will play a key role in the future for obtaining insights into exciting new physics lying beyond the Standard Model.

We look forward to new results and the next (14^{th}) International Conference on B-Physics at Hadron Machines.

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