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B Physics at the Tevatron: Run II and Beyond

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Preface

This report presents the results of the workshop devoted to study *B Physics at the Tevatron: Run II and Beyond*. Like other workshops on the physics potential of Run II of the Tevatron, held at Fermilab from 1998–2000, this workshop brought together theorists from around the world and experimenters from the CDF, DØ, and BTeV collaborations, and elsewhere.

There were two general meetings held at Fermilab: during September 23–25, 1999, and February 24–26, 2000. The working groups also held additional interim meetings to report on their progress and plan further work. The resulting physics studies can be found in Chapters 6–9. The other chapters in this report provide theoretical background on B decays (Chapter 1), common experimental issues (Chapter 2), and brief descriptions of the CDF, DØ, and BTeV detectors (Chapters 3–5).

Flavor physics and CP violation will be a major focus of experimental high-energy physics in the coming decade. The preceding decade verified at a high precision the gauge sector of the Standard Model through a wide range of experimental tests. While many extensions of the Standard Model contain new sources of flavor and CP violation, these sectors of the theory are poorly tested at present. Precise tests of the flavor sector of the Standard Model and the origin of CP violation will come from sometimes competitive and sometimes complementary measurements at the Tevatron and at the e^+e^- B factories. Chapter 10 summarizes the results of the workshops for the most interesting processes.

This report represents the status of the field around the Summer of 2001. Both the state of the theory and the experimental possibilities continue to advance. The results presented here are thus not a final view of what the experiments can achieve. This report concentrates on aspects of B physics accessible mainly to hadron colliders, and it is hoped that it will prove a ready and complete reference and aid new collaboration members and maybe others interested in the field as well.

These workshops could not have been organized without the help of many people. The organizers would like to especially thank the support of Mike Witherell and the Fermilab Directorate; the help of Cynthia Sazama and Patti Poole of the Fermilab Conference Office with the general meetings' organization; and Lois Deringer and Laura Sedlacek in the Fermilab Theory Group for taking care of so many things.

Workshop Structure

The workshop formed four semi-autonomous working groups. Each was led by two theory conveners and a convener from each experiment.

- **CP Violation**
  Yossi Nir, Helen Quinn, Manfred Paulini (CDF), Rick Jesik (DØ), Tomasz Skwarnicki (BTeV)
- **Rare and Semileptonic Decays**
  Aida El-Khadra, Mike Luke, Jonathan Lewis (CDF), Andrzej Zieminski (DØ), Ron Poling (BTeV)
- **Mixing and Lifetimes**
  Ulrich Nierste, Mikhail Voloshin, Christoph Paus (CDF), Neal Cason (DØ), Harry Cheung (BTeV)
- **Production, Fragmentation, Spectroscopy**
  Eric Braaten, Keith Ellis, Eric Laenen, William Trischuk (CDF), Rick Van Kooten (DØ), Scott Menary (BTeV)

Chapters 6 – 9 of this report present the work done in these groups.

The programs of the general meetings, including transparencies of all talks, working group information, and other documentation for this workshop can be found on the World-WideWeb at `http://www-theory.lbl.gov/Brun2/`.

The workshop was organized by Rick Jesik, Andreas Kronfeld, Rob Kutschke, Zoltan Ligeti, Manfred Paulini, and Barry Wicklund.

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