

Faculty Research Profiles



Jay R. Dittmann

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Research Interests:

High Energy Physics / The Higgs Boson

Elementary Particle Physics

Fermilab Tevatron Collider

Large Hadron Collider at CERN

The CDF and CMS Experiments

The primary goal of *High Energy Physics (HEP)*, often called *Elementary Particle Physics*, is to discover the elementary constituents of matter and energy, probe the interactions between them, and explore the basic nature of space and time.

As the first experimental HEP physicist at Baylor, Dr. Dittmann laid the foundation for a new research program and built up a HEP group from scratch. Since its beginning in 2003, the experimental HEP group has grown tremendously and is involved in several cutting-edge research projects. The group currently consists of nine members including Dr. Dittmann and Dr. Kenichi Hatakeyama, two postdoctoral research associates (Drs. Azeddine Kismi and Hongxuan Liu), and four graduate students. In addition, over the years, about 15 undergraduates have participated in experimental HEP research for honors theses, senior research projects, and summer internships.

Dr. Dittmann leads Baylor's HEP research at Fermilab in Batavia, IL, where Baylor is affiliated with the world-renowned Collider Detector at Fermilab (CDF) experiment. Despite its success for over 25 years, the experiment has recently ceased the collection of new data. The last proton-antiproton collisions in the Tevatron collider at Fermilab occurred on September 30, 2011. Nonetheless, plenty of data remains to be analyzed, and the CDF experiment will continue to publish new results for a few years.

In anticipation of the end of the Tevatron at Fermilab, the Baylor HEP group has actively pursued other experimental collaborations. In 2010, Baylor created a new affiliation with the CMS experiment at CERN, the location of the Large Hadron Collider (LHC) in Geneva, Switzerland. As a relatively small university group, it was an honor to be accepted into a world-class experimental collaboration like CMS, which includes many prominent U.S. universities. Baylor's acceptance

into the CMS collaboration was an acknowledgment of the group's significant contributions to the research field. As Dr. Dittmann's research on the CDF experiment ramps down, and his Ph.D. students complete their degrees, he will become increasingly involved on the CMS experiment.

The Baylor HEP group reached a tremendous milestone in May 2011 with the graduation of Drs. Samantha Hewamanage and Martin Frank, the group's first Ph.D. students. Sam searched for "anomalous" physics in proton-antiproton collisions in which a photon is produced with "jets" of energetic particles. Upon graduating, Sam began a new postdoctoral research position at Florida International University working on the CMS experiment. Martin was a key player in the quest to discover the infamous Higgs boson in the *WH* channel, and his results improved the experimental limits on Higgs boson production. Martin has moved on to a postdoctoral research position at the University of Virginia, where he pursues experimental HEP on the NOvA and Mu2e collaborations.

Dr. Dittmann currently works with two other Ph.D. students, Karen Bland and Zhenbin (Ben) Wu, who are busily engaged in data analyses for their Ph.D. theses. Karen is actively investigating the case where a Higgs boson decays into two photons. Her work, together with that of Baylor's CDF postdoc, Dr. Kismi, has captured the attention of the international HEP community, and a manuscript based on their work has recently been submitted to *Physical Review Letters*. Ben is studying the production and decay of top quarks, particularly rare cases where a top quark is produced by itself instead of in conjunction with an anti-particle partner. Ben is one of the key players on this analysis at CDF and he has given multiple presentations of his work at CDF collaboration meetings.

Dr. Dittmann is a member of the Executive Board of the CDF Collaboration at Fermilab. He is a co-author of many publications in *Physical Review Letters* and *Physical Review D*. Funding for the Experimental High Energy Physics group at Baylor has been provided over the years by grants from the U.S. Department of Energy, Fermilab, and Baylor University, with external grant funds totaling over \$720,000.

Recent Selected Publications:

Limits on Anomalous Trilinear Gauge Couplings in $Z\gamma$ Events from Proton-Antiproton Collisions at 1.96 TeV, T. Aaltonen *et al.* (CDF Collaboration), *Phys. Rev. Lett.* **107**, 051802 (2011).

Evidence for a mass dependent forward-backward asymmetry in top quark pair production, T. Aaltonen *et al.* (CDF Collaboration), *Phys. Rev. D* **83**, 112003 (2011).