

Curriculum Vitae

Assistant Professor Matthew Herndon

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Education

Ph.D., Physics, University of Maryland, November 1998
Thesis topic: Search for the B_c Meson in Hadronic Z^0 Decays
Thesis adviser: Professor Hassan Jawahery

B.S., Physics, University of Texas at Austin, August 1994

Academic Honors

University of Texas at Austin
National Merit Scholarship (1988-1992)
Farah Corporation Scholarship (1989)
University of Texas Honors Scholar (1991)
Golden Key Honor Society (1991)
Applied Research Laboratory Scholarship (1991-1992)

Professional Employment

8/05 to present: Assistant Professor, Department of Physics, University of Wisconsin-Madison:

Research

Participating in the CDF and CMS experiments. Currently I am co-convener of the CDF Higgs Discovery Group. This group is newly formed to meet the challenge of searching for the Higgs boson at CDF. The recent results for Higgs searches indicate that the Tevatron has the potential to exclude the range of mass allowed by the Standard Model if the Higgs does not exist and to possibly discover the Higgs where our sensitivity is the strongest. Previously I was co-convener of the CDF B Physics group. As B group convener I direct the CDF B and Charm physics program, which is one of the six major physics divisions of the experiment. The B physics group was conducting more than 50 physics analyses including diverse subjects such as the recently published first observation and measurement of the oscillation frequency of the B_s meson and searches for extremely rare decays of B mesons which could only occur in models of physics beyond the Standard Model of particle physics. Of the ongoing analysis 25 have been published, including the first five published papers of CDF Run 2 representing about half the physics output of the CDF Run 2 collaboration. In addition to serving in the B physics group I am initiating a project to improve the performance of the forward track finding using the CDF silicon micro-vertex detector. Finding tracks in this region with high efficiency will allow the identification of forward leptons which are an interesting signal to detect the evidence of many possible new physics particles. Tracking using the silicon micro-vertex detector will also be the primary method of finding tracks and leptons in the CMS detector and the ideas developed and tested at CDF will be applicable to that experiment as well where signatures involving high momentum leptons will be an excellent method to search for the signs of new physics.

Students

Jason Nett - Graduate Student, thesis topic: Search for the standard model Higgs boson in the channel $WH \rightarrow \ell\nu b\bar{b}$ at CDF, 2006-present.

Michael Glatzmaier - Graduate Student, summer student working on silicon detector safety at CDF, Summer 2006.

Teaching

Fall 2005 - Physics 107, Ideas of Modern Physics

Spring 2005 - Physics 104, General Physics II

Fall 2006 - Physics 107, Ideas of Modern Physics

Sprint 2007 - Physics 103, General Physics I

Departmental

Colloquium Committee, 2006-present.

Preliminary Exam Committee, 2005-present.

Qualifying Exam Committee, 2006-present.

Other Professional Activities

Organizing Wisconsin High Energy Physics Seminar

Organizer "Heavy Flavor Physics and Search for New Particles" session at the Particles and Nuclei International Conference, 2005, Santa-Fe, New Mexico.

Organizer "B Physics" session at the American Physical Society April Meeting, 2007, Jacksonville, Florida.

Organizer "Heavy Flavor Physics" session at the Hadron Collider Physics Symposium, 2007, Elba, Italy.

11/98 to 8/05: Associate Research Scientist, Department of Physics and Astronomy, Johns Hopkins University (Mentor: Professor Bruce Barnett): As a research scientist for Johns Hopkins University I participated in the silicon and offline software upgrade projects and the physics program of CDF Run II experiment. My activities include the following: Co-leadership of the CDF B physics group. Co-leadership of the J/ψ physics subgroup. As co-leader of the J/ψ subgroup I supervise low transverse momentum dilepton physics including subjects from rare decay searches to mass, lifetime and branching ratio measurements of b hadrons such as the B_c . The J/ψ subgroup is one of the most productive physics subgroups at CDF with ten analyses published including the measurement of $\Delta\Gamma_{B_s}$. Leadership of the CDF Tracking software group. I was co-convenor of the CDF tracking group for three years. Service in the task force formed to study the feasibility and methods for the performance of B_s mixing measurements at CDF. Service in the task force formed to study computing usage for analysis at CDF. Leadership of the software group for the study of the silicon data during the CDF commissioning run. Managing the silicon vertex detector power supply project. This work included the design of testing procedures, the coordination of the testing and the installation of all power supplies; the design, purchasing and supervision of installation of all silicon vertex detector cabling; serving as on call expert for the silicon power supply sub system and training of new experts. I am also actively contributing to the tracking and simulation software groups. This work includes authorship software used to perform pattern recognition in the innermost silicon layer(L00). Authorship of the primary software used to study silicon data during the CDF commissioning run. Design of the interfaces used for realistic simulation of the silicon detector. Authorship of a detailed and a parameterized realistic silicon simulation in collaboration with other CDF personnel. Authorship of the primary tools used for silicon simulation validation. In addition, I help supervise the Johns Hopkins graduate students resident at Fermilab and I am working on analysis in the Exotics and B physics groups.

1/93 to 11/98: Research Assistant, Department of Physics, University of Maryland (Supervisor: Professor Hassan Jawahery): As a graduate student at the University of Maryland I worked in the High Energy Physics group on the BaBar and OPAL experiments. For the BaBar experiment I performed a study of precision Time-Of-Flight measurements using scintillator counters and Fine Mesh Photomultiplier Tubes. This work was part of an investigation of several techniques considered for hadron identification in the B factory detector (BaBar) at SLAC. An almost identical system was installed and is functioning at CDF. The study included the design, construction and analysis of the data from the prototype TOF detector in collaboration with H. Jawahery and M. Foucher. At OPAL my activities included duties

as on call expert for the Hadron Calorimeter high voltage and gas systems, rewriting the the Hadron Calorimeter simulation to correctly simulate the response of the detector to jets at LEP2 energies and improving the Hadron Calorimeter calibrations to account for non-linear calorimeter response for higher energies. My thesis analysis was a search for the B_c Meson using decay modes involving the J/ψ . The search resulted in the observation of 2 candidate events with a background of (0.63 ± 0.06) events. In addition, my physics activities included implementation of seed based jet clustering for jet finding in the hadronic W boson decay channels and implementation of W mass fit routines that made use of the Breit Wigner shape of the W resonance for use in the W mass and width analyses.

9/92-12/93: Teaching Assistant, Department of Physics, University of Maryland. My duties involved leading recitations and laboratory sessions for introductory physics courses.

Supervisor: Professor Richard F. Ellis.

1/91 to 8/92: Student Researcher, Applied Research Laboratory (Austin, Texas). Worked on naval sonar simulation.

Current Research

Current Research Interests: My research interests lie in the area of indirect and direct searches for new physics phenomena. Specifically I'm interested in investigating the predictions of the Supersymmetric(SUSY) models such as the minimal super-gravity model(mSugra) and searches for unobserved Standard Model processes such as the Higgs boson. I am also interested in B Physics. The line of research I'm currently pursuing combines these interests.

An Inclusive B Lifetime Measurement with Run II Data at CDF: An inclusive measurement of the B lifetime using J/ψ events. This analysis was one of the first physics results from CDF Run II.

$B_s \rightarrow \mu^+ \mu^-$: Currently I am working on a search for $B_s \rightarrow \mu^+ \mu^-$ with Run II Data at CDF. In various SUSY models, the branching ratio for this decay can be enhanced by one to three orders of magnitude. The enhanced branching ratio along with the upgraded acceptance for reconstructing this process in the Run II CDF detector make this a promising avenue for detecting new physics. We have recently published a limit on this branching ratio which is more than a factor of three better than previously published limits. In the next year we will update this result using new data and analysis techniques which will substantially improve the sensitivity of the analysis.

$B_s - \bar{B}_s$ Oscillations We have recently published a paper on the first observation of $B_s - \bar{B}_s$ Oscillations. The observation of this process was one of the primary goals of the Tevatron experiment and marked the end of a 20 year effort to measure this process. I participated in this analysis in my capacity as B group leader and at the more technical level of integrating the use of L00, the innermost layer of silicon, into the analysis. The improvement in decay length resolution provided by L00 enhanced the analysis by a factor of two making the observation possible.

Search for the Higgs boson In my capacity as Higgs group leader I supervise all Higgs boson searches at CDF. Personally I am participating in the $H \rightarrow WW \rightarrow \ell\nu\ell\nu$ search which is the most sensitive search at the higher masses allowed by the Standard Model. In this analysis I am involved in improving lepton identification. With my student Jason Nett I am involved in the $WH \rightarrow \ell\nu b\bar{b}$ analysis where we are redesigning trigger to maximally exploit the intermediate muon system build and maintained by Wisconsin.

Selected Publications

Primary Author

The CDF Collaboration, D. Abulencia et al., "Observation of $B_s - \bar{B}_s$ Oscillations," *Phys. Rev. Lett.* **97**, 242003 (2006).

The CDF Collaboration, D. Abulencia et al., "Measurement of the $B_s - \bar{B}_s$ Oscillation Frequency," *Phys. Rev. Lett.* **97**, 062003 (2006).

- The CDF Collaboration, D. Acosta et al., “Search for $B_s^0 \rightarrow \mu^+\mu^-$ and $B_d^0 \rightarrow \mu^+\mu^-$ Decays in $p\bar{p}$ Collisions with CDF II,” Accepted by *Phys. Rev. Lett.* (2005).
- C. Hays et al., “Inside-out Tracking at CDF,” *Nucl. Instrum. Meth. A* **538**, 249 (2005).
- The CDF Collaboration, D. Acosta et al., “Search for $B_s^0 \rightarrow \mu^+\mu^-$ and $B_d^0 \rightarrow \mu^+\mu^-$ Decays in $p\bar{p}$ Collisions at $\sqrt{s} = 1.96\text{TeV}$,” *Phys. Rev. Lett.* **93**, 032001 (2004).
- The OPAL Collaboration, K. Ackerstaff et al., “Search for the B_c Meson in Hadronic Z^0 Decays,” *Phys. Letters B* **420**, 157 (1998).
- M. Foucher, M. Herndon and H. Jawahery, “A Study of the Timing Characteristics of Scintillator Counters With Fine Mesh Photomultiplier Tubes,” *Nucl. Instr. & Meth. A* **374**, 57 (1996).

Contributing Author

- The OPAL Collaboration, K. Ackerstaff et al., “Measurement of the W Mass and Width in e+e- Collisions at $\sqrt{s} = 183\text{ GeV}$,” *Phys. Letters B* **451**, 138 (1999).
- The OPAL Collaboration, K. Ackerstaff et al., “Measurement of the W Boson Mass and W+W- Production and Decay Properties in e+e- Collisions at $\sqrt{s} = 172\text{ GeV}$,” *Eur. Phys. J.* **C1**, 395 (1997).
- The OPAL Collaboration, K. Ackerstaff et al., “Measurement of the Mass of the W Boson in e+e- Collisions at $\sqrt{s} = 161\text{ GeV}$,” *Phys. Letters B* **389**, 416 (1996).

Technical Contributions

- The CDF Collaboration, D. Acosta et al., “Measurement of the J/ψ Meson and b-Hadron Production Cross Sections in $p\bar{p}$ Collisions at $\sqrt{s} = 1.96\text{TeV}$,” *Phys. Rev. D* **71**, 032001 (2005).
- The CDF Collaboration, D. Acosta et al., “Measurement of Prompt Charm Meson Production Cross Sections in p anti-p Collisions at $\sqrt{s} = 1.96\text{ TeV}$,” *Phys. Rev. Lett.* **91**, 241804 (2003).

Publications

For full listing see: http://www.hep.wisc.edu/~herndon/mfh_cv_pub.pdf

Conference Talks

- “Searches for New Physics in the Flavor Sector at the Tevatron,” DIS 2005 XIII International Workshop on Deep Inelastic Scattering, Madison, Wisconsin, April 27 - May, 2005.
- “ $B_{s(d)} \rightarrow \mu^+\mu^-$ and Direct Searches,” CKM 2005, Workshop on the Unitarity Triangle, B, San Diego, California, March 15-18, 2005.
- “Searches for FCNC Decays $B_d/B_s \rightarrow \mu\mu$,” 32nd International Conference on High Energy Physics, Beijing, China, August 16-22, 2004.
- “New B Physics Results from CDF,” The Tevatron Connection, Batavia, IL, August 9-10, 2004.
- “CDF Experience with Tracking Software,” CMS Tracking Workshop, FermiLab, Batavia, Illinois, August 3rd, 2004.
- “Tracking at CDF,” Computing in High Energy and Nuclear Physics, La Jolla, California, March 24-28, 2003.
- “B Physics at CDF,” XVII Les Recontres de Physique de la Vallée d’Aoste, La Thuille, Italy, March 9-15, 2003.
- “Search for the B_c Meson in Hadronic Z^0 Decays,” 1998 Joint American Physical Society and American Association of Physics Teachers Meeting, Columbus, Ohio, April 18-21, 1998.
- “Measurements of the B_s^0 and Λ_b^0 Lifetimes,” 1998 Joint American Physical Society and American Association of Physics Teachers Meeting, Columbus, Ohio, April 18-21, 1998.

Invited Seminars and Colloquia

“B Physics at Hadron Colliders”, Fermi National Accelerator Laboratory Academic Lectures, Batavia, Illinois, February 8th, 2007.

“Matter/Antimatter Oscillations” Wayne State University Physics Colloquium, Detroit, Michigan, October 19th, 2006.

“Matter/Antimatter Oscillations” University of Wisconsin Physics Colloquium, Madison, Wisconsin, September 27th, 2006.

“B Physics at the Tevatron” SSI 2006, 34th SLAC Summer Institute On Particle Physics, Menlo Park, California, July 17-28, 2006

“Search for FCNC Decays $B_{s(d)} \rightarrow \mu\mu$ ” Carnegie Mellon University University of Pittsburgh High Energy Physics Seminar, Pittsburgh, Pennsylvania, May 3rd, 2006.

“Searches for FCNC Decays $B_d/B_s \rightarrow \mu\mu$,” University of Minnesota, Minneapolis, Minnesota, February 11th, 2005.

University of Wisconsin-Madison, Madison, Wisconsin, January 25th, 2005.

“Current CDF B Physics Results,” Stanford Linear Accelerator Center, Menlo Park, California, October 7th, 2004.

“Rare Beauty and Charm Decays and Indirect Searches for New Physics,” University of Toronto, Toronto, Canada April 14th, 2004

Lawrence Berkeley National Laboratory Research Progress Meeting, Berkeley, California March 30, 2004.

University of Michigan HEP/Astro Seminar, Ann Arbor, Michigan, February 9, 2004.

University of Pennsylvania, Philadelphia, Pennsylvania January 26th, 2004

Rutgers High Energy Physics Seminar, Piscataway, New Jersey, November 11, 2003.

MIT Nuclear and Particle Physics Colloquium, Boston, Massachusetts, September 8, 2003.

“Search for $B_s \rightarrow \mu\mu$ Decays,” Notre Dame High Energy Physics Seminar, South Bend, Indiana, February 28, 2003.