Application to Graduate with Honors

Student ID: 810677540

I plan to defend in: FALL / (SPRING) of 20 11

Personal Information:

Name: Kevin Fiedler

Address: 1165 Bear Mountain Dr. Unit F
Boulder, CO 80305

CU E-mail: fiedlekr@colorado.edu

I am an: (IN-STATE) / OUT-OF-STATE student

Academic Information:

☑ I plan to graduate with *Departmental Honors* in: Physics

☐ I plan to graduate with *General Honors*

Cumulative GPA:

Please attach a brief **PROSPECTUS, BIBLIOGRAPHY,** and **TIMELINE** of your thesis project to this application. When summarizing your work, consider the following:

- What is the problem you are investigating?
- What is the hypothesis you are testing?
- What is the focus of your study?
- What is your goal in this study?

Primary thesis advisor: Name: Uriel Nauenberg Dept: Physics

List the other members of your committee:
Name: Alexander Gorokhovsky Dept: Mathematics
Name: John Cumalat Dept: Physics
Name: Dept:
Name: Dept:

Departmental and General Honors Committee Checklist:

☒ Applicant has a total of at least three committee members.
☒ At least one Honors Council Representative is included on committee.
☒ At least one committee member from an outside department.

APPLICATION CONTINUED ON BACK OF THIS SHEET

Please initial if you are pursuing Departmental Honors:

KRF I have consulted with my department and have completed (or am completing) the requirements they have established.

For Honors Council Representative:

I have met with applicant and approve him/her for departmental honors.

Printed Name: John P. Cumalat Signature: John P. Cumalat

Please initial if you are pursuing General Honors:

_____ I have completed (or am completing) the requirements for graduating with General Honors.
Please list the courses you have or are taking toward General Honors:

_____ _____

_____ _____

For General Honors Council Member:

I have met with applicant and approve him/her for general honors. I agree to be on his/her defense committee.

Printed Name: John P. Cumalat Signature: John P. Cumalat

For the Thesis Advisor:

I have met with the applicant to discuss the proposed work and agree to provide the necessary help and direction for this thesis project.

Printed Name: URIEL NAVENBERG Signature: Uriel Navenberg

For the Student:

I have read the requirements for graduating with honors at the University of Colorado. I also understand that my designation will be sent to the CU email address that I have provided and will not be given out over the phone.

Signature: Kevin R Siedler Date: 11/16/10

For additional graduation information including requirements, guidelines and deadlines, you can download them online at www.colorado.edu/honors

Signal Analysis and Mass Measurement of the Light Chargino at the International Linear Collider

Kevin Fiedler
Advisor: Uriel Nauenberg

For this study, the capabilities of the International Linear Collider (ILC) will be examined with respect to the light chargino signal at several supersymmetry parameter points. The supersymmetry model used for this study is minimal supergravity (mSUGRA). These parameter points are representative of larger regions in the mSUGRA parameter space and will demonstrate the capabilities of the ILC to handle a variety of different physics scenarios. This follows from the fact that the masses of the supersymmetric particles differ with the parameter points and present different reconstruction challenges. At each kinematically accessible parameter point, a mass measurement of the light chargino is important because the chargino is often the second lightest supersymmetric particle. This makes it important in constraining or measuring the mass of the lightest supersymmetric particle, or neutralino. The neutralino is a promising candidate for dark matter because it is heavy and does not interact electromagnetically.

My efforts are currently focused on incorporating the results of another part of the Nauenberg group into the reconstruction package. In this vein, I am adding the effect of a high efficiency BeamCal, which resides in the far forward region of the detector, to demonstrate the increased sensitivity and background rejection capabilities afforded by this extra detector coverage. Once this is complete, the standard model background as well as the supersymmetric signal will be regenerated to include these results. Then, a signal analysis will take place in which the supersymmetry signal of interest in disentangled from the standard model background. Ideally, this will lead to mass measurements at all kinematically accessible points with a 500 GeV center of mass energy for the collider. In particular, the difference that adding the BeamCal into the reconstruction process makes will be highlighted to demonstrate the need for a high efficiency BeamCal.

Kevin Fiedler

Timeline

- September 2010 – Finish signal analysis with 100 fb^{-1} of data at mSUGRA parameter points B', E', and α.
- October 2010 – Begin investigating signal analysis with 250 fb^{-1} of data.
- November 2010 – Regenerate Standard Model background files with new efficiencies.
- December 2010 – Verify accuracy and compile results of event generation.
- January 2010 – Reanalyze 100 fb^{-1} chargino signals and create associated plots.
- February 2010 – Analyze 250 fb^{-1} chargino signals and create associated plots.
- March 2010 – Finish writing thesis and begin presentation.
- April 2010 – Finish presentation and defend thesis.

References

[1] M. Battaglia et.al. Updated Post-WMAP Benchmarks for Supersymmetry. 2003. arXiv: hep-ph/0306219v1.
[2] M. Battaglia et al. Physics Benchmarks for the ILC Detectors. 2006. arXiv: hep-ex/0603010.
[3] Carola F. Berger, James S. Gainer, JoAnne L. Hewett, Ben Lillie, and Thomas G. Rizzo. General Features of Supersymmetric Signals at the ILC: Solving the LHC Inverse Problem. 2007. arXiv: hep-ph/0712.2965.
[4] M. Boonekamp et. al. Threshold Scan in Diffractive W Pair Production via QED Processes at the LHC. 2007. arXiv: hep-ph/0709.2742.
[5] Nick Danielson. Determining the Mass of the Snuetrino and Chargino By Examining the Snuetrino Sneutrino Production Mode. hep-www.colorado.edu/SUSY/grpwk_anal.html.
[6] Elizabeth Goodman. The Search for the Supersymmetric Selectron. http://hep-www.colorado.edu/SUSY/grpwk_anal.html.
[7] David Griffiths. Introduction to Elementary Particles. WILEY-VCH, Portland, Oregon, 2008.
[8] Andrew Hahn. An Analysis of Selectron Masses Including the Effects of Beamstrahlung. hep-www.colorado.edu/SUSY/grpwk_anal.html.
[9] S. Martin. A Supersymmetry Primer. 2006. arXiv: hep-ph/9709356.
[10] N. Metropolis. Beginning of the Monte Carlo Method. 1987. http://library.lanl.gov/la-pubs/00326866.pdf.
[11] Donald H. Perkins. Introduction to High Energy Physics. Cambridge University Press, 4th edition, 2000.
[12] Comput. Phys. Commun. 153 (2003) 275. arXiv:hep-ph/0301101.
[13] Brook Williams. Study of the Production of Supersymmetric Particles. hep-www.colorado.edu/SUSY/grpwk_anal.html.