1 Scientific Accomplishments

During the past year, though I have worked on several projects related to LHC/ILC collider physics, the bulk of my time has been spent on an analysis of a 'generalized' supersymmetry(SUSY) model. (Various parts of this work have been done in collaboration with SLAC post-doc Carola Berger, now at MIT, graduate students Randy Cotta, John Conley and Randy Cotta as well as Prof. JoAnne Hewett.) Up until this analysis, studies of MSSM have been dependent upon the type of SUSY breaking (mSUGRA, AMSB, GMSB, *etc*) and involved a number of assumptions such as high scale mass unification. As such the associated model space was rather small, perhaps only 4-5 parameters. In our analysis we considered a much more general MSSM assuming only (i)CP-conservation, (ii) Minimal Flavor Violation and (iii) degenerate first two generation sfermions with negligible Yukawa couplings. This leaves a 19 parameter space to carefully restrict by imposing a rather large number of both theoretical and experimental constraints; imposing the direct SUSY constraints from the Tevatron required the use of fast detector simulations. In order to examine any bias in our scanning of this large parameter space two different priors were employed but were shown to lead to essentially identical results. This analysis require $\sim$ 100 CPU-years of time to complete and led to a set of $\sim$ 71k parameter space points(=models) which satisfy all existing constraints. The properties of many of these models were found to be quite distinct from models previously examined

We are now making several detailed studies with this models set: (i) we are presently running these models through the ATLAS SUSY analysis suite which requires detailed fast detector simulation and uses the SM backgrounds as provided by ATLAS. This analysis will allow us to explore how well the ATLAS searches will do in studying a more general SUSY parameter space than *e.g.*, mSUGRA. Given our preliminary results the expectation is that roughly $\sim 5-10$k models will require a modification of or additions to the present SUSY search techniques if they are to produce a significant signal. (ii) We are studying the implications of this large model set for Dark

Matter searches as performed by, *e.g.*, CDMS and FERMI and will determine whether or not any of them can lead to PAMELA-like positron excess signals.

2 Professional Activities

2.1 Publications

- T. G. Rizzo, "Indirect Searches for Z'-like Resonances at the LHC," arXiv:0904.2534 [hep-ph], to appear in JHEP.
- R. C. Cotta, J. S. Gainer, J. L. Hewett and T. G. Rizzo, "Dark Matter in the MSSM," arXiv:0903.4409 [hep-ph], to appear in the New Journal of Physics.
- C. F. Berger, J. S. Gainer, J. L. Hewett and T. G. Rizzo, "Supersymmetry Without Prejudice," JHEP **0902**, 023 (2009)
- T. G. Rizzo, "Unique Signatures of Unparticle Resonances at the LHC," JHEP **0811**, 039 (2008)
- H. Davoudiasl and T. G. Rizzo, "New Dimensions for Randall-Sundrum Phenomenology," JHEP **0811**, 013 (2008)
- T. G. Rizzo, "Identification of the Origin of Monojet Signatures at the LHC," Phys. Lett. B **665**, 361 (2008)
- T. G. Rizzo, "Z' Coupling Information from the LHeC," Phys. Rev. D **77**, 115016 (2008)

2.2 Presentations

- "Supersymmetry without Prejudice". LHC Theory Workshop. TRIUMF National Lab. Vancouver, Canada. April 27,2009

- "TeV-Scale BLACK HOLES at the LHC". West Coast Theory LHC Meeting, UC Riverside, April 17, 2009
- "General SUSY Study: Beyond CMSSM/mSUGRA". Talk given to the ATLAS SUSY Group, CERN. February 18, 2009
- "Distinguishing D-Y Resonances at the LHC" . LHC2FC Workshop, CERN. Feb. 18, 2009
- SUSY Without Prejudice - Talk given at LHC2FC Workshop, CERN. February 19, 2009
- SUSY Without Prejudice I: Background and Experimental Constraints. Galileo Galilei Institute. Florence, Italy. February 11, 2009
- Supersymmetry Without Prejudice. ALCPG talk. 12/18/08
- SUSY without too much Prejudice. SLAC ATLAS Talk, SLAC. 12/10/08
- SUSY Without Prejudice. ILCWS08, Chicago, IL. Nov 15-20, 2008
- SUSY Without Prejudice: Part I. KITPC, New Physics beyond the Standard Model. Beijing, China, October 21, 2008
- Z' Physics at LHC and the LHeC. 34th International Conference on High Energy Physics (ICHEP 2008). Philadelphia, August 1, 2008
- Jet Energy Studies at $>$ 1 TeV e+e- Colliders: Light Squark Jets. SiD Benchmarking Group. SLAC, July 15, 2008
- Jet Energy Studies at 1 TeV e+e- Colliders: A first look. ALCPG talk. May 10, 2008

2.3 Organizer

Session organizer for SUSY09, Northeastern University, Boston, 2009.

2.4 Reviewer

- Proposal reviewer for NSF, DOE, NSERC(Canada); also for British, Australian and various European and South American funding agencies.

- Referee for Physical Review D, Physical Review Letters, Journal of High Energy Physics, Nuclear Physics B, Physics Letters B, Physics Reports, Modern Physics Letters, European Journal of Physics, Journal of Physics G, Europhysics Letters, Classical and Quantum Gravity, Reviews of Modern Physics, Annals of Physics, Zeitschrift fur Physik. I referee, on the average, $\sim 60 - 70$ papers every year.

3 Service

SLAC Colloquium Committee 2009-?

4 Awards

2009 APS Outstanding Referee Award (chosen by a special panel of members of the American Physical Society).

5 Management Accomplishments

I spend much of my time interacting strongly with graduate students James Gainer, John Conley and Randy Cotta as their 'grandfather adviser'. The first two will be graduating this year. The four of us, as well as Prof. JoAnne Hewett, are deeply involved in the projects described above.