

Syed Shabbar Raza Rizvi

227 Sharp Lab,
University of Delaware
Newark, DE 19716
☎ +1-302-831-6538
✉ shabbar@udel.edu

Education

- 2007–To Date **PhD (Theoretical Particle Physics)**, *University of Delaware*, Newark DE USA, .
2003–2005 **M.Phil (Physics)**, *Quaid-i-Azam University*, Islamabad Pakistan.
1996 (Jan.)–**M.Sc (Physics)**, *University of Karachi*, Sindh Pakistan.
1966(Dec.)
1993–1995 **B.Sc(Hons.) (Physics)**, *University of Karachi*, Sindh Pakistan.

Experience

Research

My research is focused on predictions from supersymmetric (SUSY) grand unified theories (GUTs). I have shown in my research how one may obtain information about the underlying (high energy) GUT theory by studying the (low energy) physics at the Large Hadron Collider (LHC) and other experiments (XENON and CDMS). In particular I have been working on models with $b - \tau$ Yukawa Unification (YU) using CMSSM and SU(5) boundary conditions and have some interesting predictions. For example with $b - \tau$ YU we have shown that only neutralino-stop coannihilation mechanism (CMSSM) can bring down the relic abundance within 5σ WMAP bounds. These solutions are consistent with other collider bounds. On the other hand with SU(5) boundary conditions we recover CMSSM results for large $\tan\beta$ and for $\tan\beta \leq 20$ we have other coannihilation and resonance solutions with light CP even Higgs mass around 125 GeV. Moreover, I also worked on $t - b - \tau$ Yukawa Unifications using SO(10) and Pati-Salam boundary conditions and Gauge-Yukawa Unification using Pati-Salam boundary conditions. In SO(10) model we showed that one could have heavy gluino consistent with 10% or better $t - b - \tau$ YU. These results were missed by previous studies. I also have dealt SUSY models with non-universalities like non-universal gaugino masses, non-universal Higgs masses and non-universal A-terms with out imposing any YU conditions. With my collaborators I have described in detail the conditions under which the neutralino-sbottom coannihilation scenario can be realized in SUSY SU(5). In particular we have identified, for the first time we believe, the minimum number of soft SUSY breaking parameters that are required in order to have NLSP sbottom and neutralinosbottom coannihilation in SU(5). I also have been considering the results coming from direct (XENON100, CDMS) and indirect searches (IceCube, Super-K) of dark matter in order to constraint out models.

Teaching

I have been a “Teaching Assistant” for several courses.

Future Plans and interests

I would like to continue SUSY GUT model building and phenomenology. As nowadays we have the advantage of having new results from the LHC, I will be interested in collider physics to test the validity of models. I am also open to work on new ideas in physics beyond the standard model. I have not worked in cosmology but I will be very happy if I have interesting problems to work at.

Academic Honors and Achievements

Working as a Research Assistant at Department of Physics and Astronomy, University of Delaware.

University of Delaware Physics Department Travel Grant Award (2011-2012).

University of Delaware Professional Development Award (2011).

Worked as a Research Assistant at National Center for Physics, Quaid-i-Azam University, Islamabad, Pakistan(2004-2005).

First Class Second Position in M.Sc.

Current Projects

In one project which I am doing with N. Okada and Q. Shafi, we are studying SU(5) boundary conditions to have solutions with light CP even Higgs mass around 125 GeV and also consistent with all the constraints including muon anomalous magnetic moment bounds. We are now completing the first draft of our paper.

In the second project I am studying collider signals of heavy gluinos with 8 TeV and 14 TeV LHC data with T. Li and Q. Shafi.

In the third project with I. Gogoladze, B. He and Q. Shafi, we plan to investigate the impact of low scale inverse seesaw mechanism for neutrinos on the sparticle spectroscopy. It was noted in arXiv:1209.5984 [hep-ph] that a low scale inverse seesaw mechanism can yield significant contributions to the light CP-even Higgs boson mass. This contribution allows one to have a relatively light stop quark, as well as other relatively light sparticles, which makes them accessible at the LHC. A much more elaborate study of the low energy spectrum using ISAJET, FeynHiggs and other programs will be carried out. This project is in its initial stages and will take some time to complete. Currently we are doing necessary changes in our computer code for the detailed analysis.

Computer Skills

Programming Languages: Fortran.

Symbolic Software: Mathematica.

Collider Simulation and Analysis package: ISAJET, MadGraph, PYTHIA, PROSPINO.

SUSY spectrum generator: ISAJET, SusPect, SoftSusy.

Dark Matter packages: IsaTools, DarkSusy.

Working experience on local and remote clusters like "Extreme Science and Engineering Discovery Environment (XSED)"

Operating Systems: Unix/Linux, Windows.

Schools and Conferences Attended

7th Annual Fermilab-CERN Hadron Collider Physics Summer School: Fermilab, August 6 - 17 (2012).

Phenomenology Symposium: University of Pittsburgh, May 7-9 (2012).

Brookhaven Forum 2011: A First Glimpse of the Tera Scale, October 19-21, Brookhaven National Lab (2011).

BCVSPIN Advanced Study Institute In Particle Physics and Cosmology, July 25-30, Hue, Vietnam (2011).

Theoretical Advanced Study Institute (TASI) in Elementary Particle Physics, June 6- July 1, University of Colorado, Boulder (2011).

Workshop on Major DUESL Physics Topics, October 1-3, South Dakota School of Mines and Technology, Rapid City (2010).

12th Regional Conference on Mathematical Physics, 27 March - 1 April, Islamabad, Pakistan (2006).

Summer School on Particle Physics, June 13-24, ICTP, Trieste Italy (2005).

3rd Particle Physics Workshop on Particle Physics, Department of Physics QAU Islamabad, Pakistan (2004).

Talks

Phenomenology Symposium: University of Pittsburgh, May 7-9 (2012).

Brookhaven Forum 2011: A First Glimpse of the Tera Scale, October 19-21, Brookhaven National Lab (2011).

BCVSPIN Advanced Study Institute In Particle Physics and Cosmology, July 25-30, Hue, Vietnam (2011).

Student Talks, Theoretical Advanced Study Institute (TASI) in Elementary Particle Physics, June 6- July 1, University of Colorado, Boulder (2011).

References

Prof. Qaisar Shafi

Bartol Research Institute and Department of Physics and Astronomy

252 Sharp Lab

University of Delaware

Newark, DE 19716, USA

Phone: (302) 831-6876

Email: shafi@bartol.udel.edu

Prof. Howard Baer

Department of Physics

University of Oklahoma

315 Nielsen Hall

Norman, OK 73019-2061

Phone: (405) 325-3961 ext. 36315

E-mail: baer@nhn.ou.edu

Nobuchika Okada
Department of Physics and Astronomy
The University of Alabama
Office:320A
Tuscaloosa, AL 35487-0324
Phone:(205) 348-2837
E-mail: okadan@ua.edu

Dr. Ilia Gogoladze
Bartol Research Institute and Department of Physics and Astronomy
University of Delaware, Newark,DE 19716, USA
Phone:(302) 831-0042
Email:ilia@bartol.udel.edu

Publications

1. H. Baer, S. Raza and Q. Shafi, “A Heavier gluino from $t - b - \tau$ Yukawa-unified SUSY,” Phys. Lett. B **712**, 250 (2012) [arXiv:1201.5668 [hep-ph]].
2. H. Baer, I. Gogoladze, A. Mustafayev, S. Raza and Q. Shafi, “Sparticle mass spectra from SU(5) SUSY GUT models with $b - \tau$ Yukawa coupling unification,” JHEP **1203**, 047 (2012) [arXiv:1201.4412 [hep-ph]].
3. I. Gogoladze, S. Raza and Q. Shafi, “Neutralino-Sbottom Coannihilation in SU(5),” JHEP **1203**, 054 (2012) [arXiv:1111.6299 [hep-ph]].
4. N. Okada, S. Raza and Q. Shafi, “Particle Spectroscopy of Supersymmetric SO(10) with Non-Universal Gaugino Masses,” Phys. Rev. D **84**, 095018 (2011) [arXiv:1107.0941 [hep-ph]].
5. I. Gogoladze, S. Raza and Q. Shafi, “Light Stop from b-tau Yukawa Unification,” Phys. Lett. B **706**, 345 (2012) [arXiv:1104.3566 [hep-ph]].
6. I. Gogoladze, R. Khalid, S. Raza and Q. Shafi, “Higgs and Sparticle Spectroscopy with Gauge-Yukawa Unification,” JHEP **1106**, 117 (2011).
7. I. Gogoladze, R. Khalid, S. Raza and Q. Shafi, “ $t - b - \tau$ Yukawa unification for $\mu < 0$ with a sub-TeV sparticle spectrum,” JHEP **1012**, 055 (2010).
8. I. Gogoladze, R. Khalid, S. Raza and Q. Shafi, “CDMS II Inspired Neutralino Dark Matter in Flipped SU(5),” Mod. Phys. Lett. A **25**, 3371 (2010).