

CURRICULUM VITAE

Ahmed Rashed

Personal Information

- **Name:** Ahmed Mohammed Mostafa Rashed
- **Date of Birth:** February 12, 1979
- **Nationality:** Egyptian
- **Gender:** Male
- **Present Address:** 1731 Anderson Rd, Apt (5), Oxford, MS, 38655, USA
- **Permanent Address:** Apt (41), Bldg 13, Mashroa 19 Emara, Toob Ramly, Nasr City, Cairo, Egypt
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- **Home Phone:** +1-601-262-5670
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Appointments

- Teaching/Research assistant and graduate student at the University of Mississippi, USA, Jan. 2009-present.
- Assistant lecturer at Ain Shams University, Egypt, 2000-2007.

Education

1. **Ph.D. (Jan. 2009-Present)**
Institution: University of Mississippi, USA
Major: Particle Phenomenology
Supervisor: Alakabha Datta (datta@phy.olemiss.edu)
2. **M.A. (Dec 2011)**
Institution: University of Mississippi, USA
Major: Physics
3. **Diploma (2008)**
Institution: African Institute for Mathematical Science (AIMS), South Africa
Major: Mathematical Science and Theoretical Physics
4. **M.Sc. (2006)**
Institution: Ain Shams University, Egypt
Major: Theoretical Optics
5. **B.Sc. (2000)**
Institution: Ain Shams University, Egypt
Major: Physics

Areas of Research Interest

Particle physics beyond the Standard Model, neutrino, top quark, and Higgs Physics.

Honors and Awards

- Dissertation Fellowship Award, University of Mississippi, 2012.
- Scientific Publications Award, Misr El-Kheir Foundation, Egypt, 2012.
- Tutorial performance award for outstanding pedagogy in presentation, the international neutrino summer school 2012, Virginia Tech and Fermilab, 2012.
- Summer Research Assistantship, University of Mississippi, (2011-2012).
- Graduate Student Council Research Grant 2011-2012, University of Mississippi, 2011.

- American Physical Society FGSA Travel Award, 2011.
- Zdravko Stipcevic Honors Fellowship, University of Mississippi, 2010-till graduation.
- PhD scholarship from the University of Mississippi, January 2009-present.
- Diploma scholarship from the African Institute for Mathematical Science (AIMS), 2008.

Memberships

- Sigma Pi Sigma **Honor** Society ($\Sigma\Pi\Sigma$).
- American Physical Society (APS).
- Mississippi Academy of Sciences (MAS).
- Society of Physics Students (SPS).

Teaching Experience

- 2000-2006, Ain Shams University, General physics laboratories.
- 2009-2010, University of Mississippi, General physics laboratories.
- I taught classes as an assistant in Quantum Mechanics I (Phys 611) and Senior Review (Phys 498).

Conferences/Workshops

1. “Behind Neutrino Mass - Workshop on theoretical aspects of the neutrino mass and mixing”, ICTP in Trieste, Italy, September 17-21, 2012.
2. “The 4th International Summer School on Neutrino Physics (INSS2012)”, Virginia Tech’s Center for Neutrino Physics in Blacksburg, Virginia, USA, July 10-21, 2012.
3. “Fundamental Physics at the Intensity Frontier Workshop”, Rockville, MD, Nov.30-Dec.2, 2011.

4. “International Conference on Neutrino Physics in the LHC Era”, Luxor, Egypt, Nov. 15-19, 2009.
5. “Introductory School on Gauge Theory/Gravity Correspondence”, ICTP, Italy, May 19-30, 2008.
6. “The CTP Symposium on Supersymmetry at LHC: Theoretical and Experimental Perspectives”, the British University in Egypt (BUE), Egypt, March 11-14, 2007.
7. “The Second Cairo International Conference on High Energy Physics”, the German University in Cairo (GUC), Egypt, Jan. 14-17, 2006.
8. Several workshops on particle physics and cosmology, Ain Shams University and GUC, Egypt, 2001-2006.

Talks/Presentations

1. “The 2012 Phenomenology Symposium”, University of Pittsburgh, USA, May 7-9, 2012.
2. “American Physical Society (APS) April Meeting”, Atlanta, GA, USA, March 31 - April 3, 2012.
3. “The Mississippi Academy of Sciences Annual Meeting”, University of Southern Mississippi, USA, February 23-24, 2012.
4. The physics department colloquium “Neutrino Mixing at the TeV Scale and the Recent T2K Results”, University of Mississippi, USA, October, 2011.
5. Theoretical Advanced Study Institute in Elementary Particle Physics (TASI) School “The Dark Secrets of the Terascale”, University of Colorado, Boulder, Colorado, USA, June 6-July 1, 2011.
6. “The Coordinated Theoretical-Experimental Project on QCD (CTEQ) School”, University of Wisconsin- Madison, Wisconsin, USA, July 10-20, 2011.
7. “The 2011 Phenomenology Symposium”, University of Wisconsin-Madison, Wisconsin, USA, May 9-11, 2011.
8. “The Mississippi Academy of Sciences Annual Meeting”, University of Southern Mississippi, USA, February 17-18, 2011.

9. A poster at the XXXVIII SLAC Summer Institute (SSI) 2010, “Neutrinos Natures Mysterious Messengers.”, SLAC, USA, August 2-13, 2010.

Travel Awards

1. “Behind Neutrino Mass - Workshop on theoretical aspects of the neutrino mass and mixing”, ICTP in Trieste, Italy, September 17-21, 2012, **(Full coverage)**.
2. “The 4th International Summer School on Neutrino Physics (INSS2012)”, Virginia Tech’s Center for Neutrino Physics in Blacksburg, Virginia, USA, July 10-21, 2012, **(USD 800)**.
3. “Fundamental Physics at the Intensity Frontier Workshop”, Rockville, MD, Nov.30-Dec.2, 2011, **(Full Coverage = USD 580)**.
4. “The Coordinated Theoretical-Experimental Project on QCD (CTEQ) School”, University of Wisconsin- Madison, Wisconsin, USA, July 10-20, 2011, **(USD 300)**.
5. TASI School “The Dark Secrets of the Terascale”, University of Colorado, Boulder, Colorado, USA, June 6-July 1, 2011, **(USD 1500)**.
6. XXXVIII SLAC Summer Institute (SSI) 2010, “Neutrinos Natures Mysterious Messengers.”, SLAC, USA, August 2-13, 2010, **(Registration fee waiving, USD 235)**.
7. “International Conference on Neutrino Physics in the LHC Era”, Luxor, Egypt, Nov. 15-19, 2009, **(USD 1000 + lodging)**.
8. “Introductory School on Gauge Theory/Gravity Correspondence”, ICTP, May 19-30 2008, **(Full coverage)**.

Computer Skills

Mathematica, FeynCalc, CalcHEP, PYTHIA, Linux, Windows.

List of Publications

<http://inspirehep.net/author/A.Rashed.1/>

Previous Work:

1. Ahmed Rashed, Murugeswaran Duraisamy, and Alakabha Datta; “Probing light pseudoscalar, axial vector states through $\eta_b \rightarrow \tau^+ \tau^-$ ”; **Phys.Rev.D82, 054031 (2010)**, **arXiv:1004.5419 [hep-ph]**.
2. Murugeswaran Duraisamy, Ahmed Rashed, Alakabha Datta; “The top forward backward asymmetry with general Z' couplings.”; **Phys.Rev.D84, 054018 (2011)**, **arXiv:1106.5982 [hep-ph]**.
3. Ahmed Rashed, Alakabha Datta; “The charged lepton mass matrix and non-zero θ_{13} with TeV scale new physics.”; **Phys.Rev.D85, 035019 (2012)**, **arXiv:1109.2320 [hep-ph]**.
4. Ahmed Rashed; “Deviation from tri-bimaximal mixing and large reactor mixing angle.”; **arXiv:1111.3072 [hep-ph]**.
5. Ahmed Rashed, Murugeswaran Duraisamy, and Alakabha Datta; “Non-standard interactions of tau neutrinos via charged Higgs and W' contribution.”; **Phys. Rev. D 87, 013002 (2013)**, **arXiv: 1204.2023 [hep-ph]**.
6. J. L. Hewett, H. Weerts, R. Brock, J. N. Butler, B. C. K. Casey, J. Collar, A. de Gouvea and R. Essig *et al.*, “Fundamental Physics at the Intensity Frontier.”. **arXiv:1205.2671 [hep-ex]**.
7. Ernest Ma, Alexander Natale, and Ahmed Rashed; “Scotogenic A_4 neutrino model for nonzero θ_{13} and large δ_{CP} ”; **Int.J.Mod.Phys. A27 (2012) 1250134**, **arXiv:1206.1570v1 [hep-ph]**.
8. Ahmed Rashed, Murugeswaran Duraisamy, Preet Sharma, and Alakabha Datta; “Tau neutrino as a probe of nonstandard interactions”

Current Work:

- Ernest Ma, Alexander Natale (UC Riverside), and Ahmed Rashed; “Radiative Scaling Neutrino Mass and Warm Dark Matter.”
- Ahmed Rashed; “Deviation from Tri-Bimaximal Mixing within a Model with $SO(3)$ Family Symmetry.”
- Alakabha Datta, Ahmed Rashed, Murugeswaran Duraisamy, Shanmuka Shivashankara; “Study of CP violation in the $t\bar{t}$ production at the LHC.”

Cover Letter

Contact Information

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Employer Contact Information

Name: University of Mississippi
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108 Lewis Hall, the University of Mississippi
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Date: February 3, 2013

Dear Sir/Madam,

I am currently a graduate student at the University of Mississippi. I started my Ph.D. program in January 2009. In August 2009, I passed the comprehensive exam. My current GPA is 3.81. I began my research in January 2010 and I have six papers at the present time. One of these papers is a single author article. My anticipated graduation year is 2013.

My experience has extended over various topics such as neutrino, top quark, and Higgs physics. I have collaborated with my colleagues in the research group in which we shared ideas and worked out projects in very constructive way. I have developed my writing skills through writing most of my papers. I have experience in applying for research grants with my advisor to the NSF and we have got the funding. Also, I have got a research grant from the Graduate Student Council as well as Dissertation Fellowship Award from the GS in my school. I attended several conferences, workshops, and summer schools. I presented my work in various places. Eventually, I have a teaching experience for about eight years. Following to what I have mentioned above, I would like to emphasize some points, I have

- extended my background to various topics in particle physics,
- a good attitude to collaborate coherently with research groups,
- the aptitude to present my work in scientific events,
- the ability to work independently,
- an experience to applying for research grants,
- got many travel awards in conferences and other scientific events,
- an experience in teaching for long time.

I hope my experience qualify me for consideration. I enclosed my CV, list of publications, and research statement along with this letter. For any further inquiries please do not hesitate to contact me. Thank you for your time.

Respectfully yours,

Ahmed Rashed

Research Statement

Ahmed Rashed
(amrashed@go.olemiss.edu)

My thesis work has revolved around three topics: neutrino, top quark, and Higgs physics. Below I give a brief description to the thesis work.

1 Previous Work

My thesis work includes several papers that are summarized below.

1.1 “Probing light pseudoscalar, axial vector states through $\eta_b \rightarrow \tau^+\tau^-$.” [1]

In this paper we studied the decay process $\eta_b \rightarrow \tau^+\tau^-$ which has an experimental upper limit at $\mathcal{BR}^U(\eta_b \rightarrow \tau^+\tau^-) < 8\%$ [2]. We estimated the branching ratio for this decay within the standard model via the gauge boson Z exchange and the two photon intermediate state to be very small as $\sim 4 \times 10^{-9}$. We showed that substantially larger branching ratios, up to the present experimental limit, can be obtained in models with a light pseudoscalar or a light axial vector state (associated with an extra-U(1) symmetry generator). Our results should be reliable when the pseudoscalar mass is away from the η_b mass because we ignored possible mixing effects between the light pseudoscalar and the η_b . The axial U -boson couplings to fermions are proportional to the mass m_U . This leads to that the branching ratio $\mathcal{BR}^U(\eta_b \rightarrow \tau^+\tau^-)$ was found to be independent of the mass of U -boson if we ignored the U decay width. Our work has shown that the decay $\eta_b \rightarrow \tau^+\tau^-$ is a good probe to introducing new physics beyond the Standard Model.

1.2 “The top forward backward asymmetry with general Z' couplings.” [3]

The CDF collaboration measured the forward-backward asymmetry ($A_{FB}^{t\bar{t}}$) in top quark pair production in the $t\bar{t}$ rest frame to be $A_{FB}^{t\bar{t}} = 0.475 \pm 0.774$ for $M_{t\bar{t}} > 450$ GeV [4], which is 3.4σ deviations from the next-to-leading order (NLO) SM prediction $A_{FB}^{t\bar{t}} = 0.088 \pm 0.013$ [5]. In this paper, we explained the $A_{FB}^{t\bar{t}}$ measurement with a light Z' gauge boson with a mass around 150 GeV and flavor changing tuZ' coupling, in the t-channel, of $g_{tuZ'} \sim O(g)$ where g is the weak coupling. We used the $B_{d,s}$ mixing to constrain the left handed $t_L u_L Z'$ couplings. These constraints resulted from the bounds on the effective $b(s, d)Z'$ vertices generated from vertex

corrections involving the tuZ' coupling and W exchange. We considered the most general form of the tuZ' interaction which includes vector-axial vector as well as tensor type couplings. We found that the tensor terms did not affect the top $A_{FB}^{t\bar{t}}$ in a significant manner. In this paper, the pure vector-axial vector coupling with left-handed chirality can explain the top forward backward asymmetry $A_{FB}^{t\bar{t}}$ measurement within 1σ error of its measurement by introducing the gauge state Z' .

1.3 “The charged lepton mass matrix and non-zero θ_{13} with TeV scale new physics.” [6]

In this paper we established a lepton mixing model to explain the recent result of the lepton mixing angle θ_{13} [7]. We provided an explicit non-diagonal structure for the Yukawa matrix of the charged leptons which is 2-3 symmetric. From our assumption to diagonalize the mass matrices by unitary matrices composed of pure numbers, we generated such a structure to the Yukawa matrix with the first generation is decoupled from the other two generations. While the neutrino mass matrix is assumed with the third generation to be decoupled from the first two generations. We assumed the bimaximal structure to be the leading order term of the lepton mixing in the symmetric limit. We used the see-saw mechanism to generate the neutrino masses. Our model extended the SM by three right handed neutrinos, an extra Higgs doublet, and two real singlet scalars. Also, the SM symmetry group was extended by a bunch of Z_2 discrete symmetries.

Symmetry breaking effects included both in the charged lepton and the neutrino sector to produce corrections to the leptonic mixing and explain the recent θ_{13} measurements. We broke the symmetry in both sectors explicitly by introducing symmetry breaking terms in the Lagrangian. A fit to the experimental measurements showed that our model predicted normal hierarchy for the neutrino masses. The absolute masses of neutrinos was expected to be in the few meV to ~ 50 meV (meV= 10^{-3} eV). Constraints on the neutrinoless double beta decay was set within the best known experimental limits. This model have some interesting points such as introducing a simple symmetry, Z_2 , to describe the neutrino mixing, and has satisfied all the experimental measurements. Also, it presents a motivative phenomenology and new particles at a reachable TeV energy scale. It predicts the see-saw scale and the VEV of the singlet scalars at an appropriate energy scale TeV that can be probed at the LHC experiments. The VEV of the extra Higgs was found to be in the MeV range. The singlet scalars with VEV in the TeV range can be a good candidate to the cold dark matter models.

1.4 “Deviation from tri-Bimaximal mixing and large reactor mixing angle.” [8]

Here I attempted to extend the previous neutrino mixing model to treat the tri-bimaximal pattern as the leading order mixing within the same 2-3 flavor symmetry. In order to treat the TBM in the symmetric limit, I have changed the flavor symmetry group to the product of $Z_4 \times U(1)$. Also, I introduced three complex singlet scalars instead of two real singlets. Consequently, I modified the Lagrangian to fit the TBM model, and changed slightly the symmetry breaking terms in the neutrino sector. The measurements of the mixing angles have been all accommodated. The final results have not changed significantly from our previous model, but the phenomenology has been modified to fit the TBM structure implications.

1.5 “Nonstandard interactions of tau neutrino via charged Higgs and W' contribution.” [9]

We considered charged Higgs and W' gauge boson contributions to the quasielastic scattering $\nu_\tau + n \rightarrow \tau^- + p$ and $\bar{\nu}_\tau + p \rightarrow \tau^+ + n$. These effects modify the standard model cross section for these processes and thus impact the extraction of the neutrino mixing angles θ_{23} and θ_{13} . We included form factor effects in our calculations and find the deviation of the actual mixing angle from the measured one, assuming the standard model cross section, can be significant and can depend on the energy of the neutrino.

1.6 “Scotogenic A_4 Neutrino Model for Nonzero θ_{13} and Large δ_{CP} ” [10]

Assuming that neutrinos acquire radiative see-saw Majorana masses through their interactions with dark matter, i.e. scotogenic from the Greek ‘scotos’ meaning darkness, and using the non-Abelian discrete symmetry A_4 , we proposed a model of neutrino masses and mixing with nonzero θ_{13} and necessarily large leptonic CP violation, allowing both the normal and inverted hierarchies of neutrino masses, as well as quasi-degenerate solutions.

2 Plan of Research

Obviously, it is vastly easier to summarize what I have already done than to speak about what I am planning to do. I am currently interested in neutrino masses and mixing and CP violation in the lepton sector. I worked in model building in order to describing neutrino mixing. I am planning to develop this background in

the future to be comprehensively understanding this area of the field. Also, I have experience in non-standard neutrino interactions and I am going to investigate this experience to work on this point of research. I also worked in different directions such as heavy quarkonium and top physics. My current plan in the near future is to work intensively in the quark sector such as top physics, B physics, QCD. Generally, I am open to work in any new field beyond my dissertation themes.

References

- [1] A. Rashed, M. Duraisamy, A. Datta, Phys. Rev. **D82**, 054031 (2010). [arXiv:1004.5419 [hep-ph]].
- [2] B. Aubert *et al.* [BABAR Collaboration], Phys. Rev. Lett. **103**, 181801 (2009). [arXiv:0906.2219 [hep-ex]].
- [3] M. Duraisamy, A. Rashed, A. Datta, Phys. Rev. **D84**, 054018 (2011). [arXiv:1106.5982 [hep-ph]].
- [4] T. Aaltonen *et al.* [CDF Collaboration], Phys. Rev. **D83**, 112003 (2011). [arXiv:1101.0034 [hep-ex]].
- [5] J. H. Kuhn and G. Rodrigo, *Phys.Rev.Lett.* **81** (1998) 49–52, [hep-ph/9802268].
J. H. Kuhn and G. Rodrigo, *Phys.Rev.* **D59** (1999) 054017, [hep-ph/9807420].
- [6] A. Rashed and A. Datta, Phys. Rev. D **85**, 035019 (2012) [arXiv:1109.2320 [hep-ph]].
- [7] Y. Abe *et al.* [DOUBLE-CHOOZ Collaboration], Phys. Rev. Lett. **108**, 131801 (2012) [arXiv:1112.6353 [hep-ex]]. F. P. An *et al.* [DAYA-BAY Collaboration], Phys. Rev. Lett. **108**, 171803 (2012) [arXiv:1203.1669 [hep-ex]]. J. K. Ahn *et al.* [RENO Collaboration], Phys. Rev. Lett. **108**, 191802 (2012) [arXiv:1204.0626 [hep-ex]]. K. Abe *et al.* [T2K Collaboration], Phys. Rev. Lett. **107**, 041801 (2011) [arXiv:1106.2822 [hep-ex]]. P. Adamson *et al.* [MINOS Collaboration], “Improved search for muon-neutrino to electron-neutrino oscillations in MINOS,” arXiv:1108.0015 [hep-ex]. D. V. Forero, M. Tortola and J. W. F. Valle, arXiv:1205.4018 [hep-ph].
- [8] A. Rashed, [arXiv:1111.3072 [hep-ph]]. “Submitted to PRD, revised version will be posted soon.”
- [9] A. Rashed, M. Duraisamy and A. Datta, arXiv:1204.2023 [hep-ph].
- [10] E. Ma, A. Natale and A. Rashed, Int. J. Mod. Phys. A **27**, 1250134 (2012) [arXiv:1206.1570 [hep-ph]].

The International Neutrino Summer School 2012 Organizers
present the
**Tutorial Performance Award for
Outstanding Pedagogy
in Presentation**
to

Ahmed Fashed

Presented July 2012, Blacksburg, USA

Leon M. Lederman
Professor Leon M. Lederman



THE UNIVERSITY OF MISSISSIPPI
GRADUATE STUDENT COUNCIL

This certificate is awarded to

Ahmed Rashed

in recognition for outstanding research in

Basic Sciences 2011-2012



Mona Axxa
Miss Harris, 2011-2012 USC President
Cheryl
Dr. Cheryl M. Kewnet, Graduate School Liaison Dean

April 30, 2012

April 30, 2012

University of Mississippi



On the Friends of Learning everywhere, Greetings

Be it known that

Ahmed Mohammed Mostafa Rashid

having completed the required course of study, is this day, by action of the Faculty and of the Board of Trustees, declared a

Master of Arts

of the University of Mississippi and is admitted
to all rights and privileges belonging to this degree.

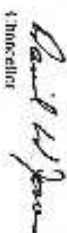
In testimony whereof is awarded this diploma duly certified by the signatures
of the proper officers, and the seal of the University, affixed this the
tenth day of December in the year of our Lord 2011 and in the 164th
year of the University.

FOR THE TRUSTEES


President



FOR THE FACULTY


Chancellor


Registrar