CURRICULUM VITAE

Name	Delgado Delgado, Antonio
Date and Place of Birth	19 May 1974, Toledo, Spain
Languages	Spanish (native), English, French
Citizenship	Spanish
Marital Status	Married
Mailing address	Dept. of Physics & Astronomy University of Notre Dame 324 Nieuwland Science Hall Notre Dame, IN 46556-5670, USA Tel.: +1 574 631 3754 Fax.: +1 574 631 5952
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ACADEMIC DEGREES

• 1997:	**Licenciatura (B. Sc.) Physics**
Universidad Autónoma de Madrid.	Madrid (Spain)
• 2001:	**Doctorado (Ph. D.) Theoretical Physics**
Universidad Autónoma de Madrid.	Madrid (Spain)
Title	*Phenomenology of TeV-Dimensions*
Supervisor	Prof. M. Quirós

Fellowships obtained:

– Student Fellowship from MEC, Spanish Education Office, 1996-1997 (Bachelor of Science)
– Research Fellowship from Spanish Education Office , 1997-2001 (Ph. D.)

PROFESSIONAL EXPERIENCE

• September 2007-:

Position	Assistant Professor
Institution	University of Notre Dame
Center	Dept. of Physics and Astronomy
Department	HEP
Postal Address	225 Nieuwland Science Hall, Notre Dame IN 46556 (USA)

• October 2004-September 2007:

Position	Postdoctoral Fellow
Institution	CERN
Center	PH-Dept.
Department	TH-Division
Postal Address	CH-1211 Geneva 23, Switzerland

• October 2001-September 2004:

Position	Postdoctoral Fellow
Institution	Johns Hopkins University
Center	Dept. of Physics and Astronomy
Department	Particle Physics
Postal Address	3400 N Charles St., Baltimore MD 21218 (USA)

• September 1997 - October 2001:

Position	Pre-doctoral Student
Institution	C.S.I.C.
Center	Instituto de Estructura de la Materia.
Department	Unidad Estructural de F´ısica Te´orica
Postal Address	Serrano 123, 28006 Madrid (Spain)

• July 1997 - September 1997:

Position	Summer Student
Institution	CERN
Department	Atlas Collaboration
Postal Address	Geneva (Switzerland)

• October 1996 - June 1997:

Position	Assistant
Institution	Universidad Aut´onoma de Madrid
Department	Departamento de F´ısica Terica.
Postal Address	Cantoblanco, Madrid (Spain)

VISITS TO OTHER INSTITUTIONS:

1. Universidad Nacional de la Plata
   March 5, 2006-April 5,2006. La Plata, Argentina.
2. IFAE, UAB
   April 5, 2005-April 17, 2005 and June 13, 2005-June 17,2005, Barcelona, Spain.
3. LPTHE, Univ. Paris VI
   February 21, 2005-February 25, 2005, Paris, France.
4. CEA, Saclay
   January 17, 2005-January 28, 2005, Paris, France.
5. IFT, CSIC
   September 1, 2004-September 30, 2004, Madrid, Spain.
6. Theoretical Physics Dept., Fermilab
   November 15, 2001-November 22, 2001, February 9, 2003
   -March 1, 2003 and May 24, 2004- June 3, 2004 , Batavia, Il, USA.

7. Particle Physics Dept., University of Virginia
   October 20,2001-October 25,2001, Charlottesville, VI, USA.
8. High Energy Physics, Theory Group, Argonne National Lab.
   October 2, 2000 - December 1, 2000, Argonne Il, USA.
9. Ecole Normale Superiere, Dept. of Theroretical Physics,
   April 3, 2000 - April 7, 2000, Paris, France.
10. Sussex University, Physics and Astronomy Faculty,
    February 14, 2000 - February 18, 2000, Brighton, U.K.
11. CERN, TH-Division,
    November 8, 1999 - November 19, 1998, Geneva, Switzerland.
12. University of Michigan, Dept. of Theoretical Physics,
    May 10, 1999 - July 9, 1999, Ann Arbor (MI), USA
13. Rutherford Appleton Laboratory, Dept. of Theoretical Physics ,
    July 1, 1998 - July 31, 1998, Oxford, UK.
14. Universidad autónoma de Barcelona, High Energy Physics Institution,
    February 10, 1998 - February 22, 1998, Barcelona, Spain.

CONFERENCES:

1. KIPTC, July 2008, Beijing, China.
2. Forum in Particle Physics, July 2008, Weihai, China. Plenary talk given.
3. Planck'08, May 2008, Barcelona, Spain. Plenary talk given.
4. Physics at TeV Colliders, June 2007, Les Houches.
5. Cracow School of Theoretical Physics, June 2007, Cracow.
6. Planck'07. June 2007, Warsaw. Plenary talk given.
7. Trends in Theoretical Physics IV, May 2007, Buenos Aires.
8. Planck'06. May 2006, Paris. Plenary talk given.
9. Corfu Summer School 2005, September 2005, Corfu, Greece.
10. SUSY-2005, July 2005, IPPP, Durham, UK.
11. Planck'05, May 2005, ICTP, Trieste, Italy.
12. SUSY-2004, June 2004, Epochal, Tsukuba, Japan.
13. Theory Institute on Higgs, SUSY and Extra Dimensions 2004, May 2004, ANL, Chicago, USA.
14. IFT/UAM Christmas Workshop, December 2003, UAM, Madrid, Spain.
15. Aspen Center for Physics, July 2003, Aspen, Colorado, USA.

16. Planck'03, May 2003, CSIC, Madrid, Spain.
17. IFT/UAM Christmas Workshop, December 2002, UAM, Madrid, Spain.
18. Aspen Center for Physics, July 2002, Aspen, Colorado, USA.
19. Theory Institute on SUSY and Extra Dimensions 2002, May 2002, ANL, Chicago, USA.
20. IFT/UAM Christmas Workshop, December 2001, UAM, Madrid, Spain.
21. Theory Institute on SUSY and Extra Dimensions 2001, May 2001, ANL, Chicago, USA.
22. Physics in Extra Dimensions, February 2001, Warsaw, Poland.
23. Conference on Physics Beyond 4D, July 3-6 2000. ICTP, Trieste, Italy.
24. Advanced School on Supersymmetry, Superstrings and Branes, July 1999. Santiago de Compostela, Spain.
25. SUSY-1999. Fermilab, Batavia (IL), USA
26. SUSY-1998. Oxford Univ., Oxford, UK.
27. Advanced School on Cosmology and Particle Physics, June 1998. Peñiscola, Spain.

Other Scholarly Activities:

Served as outside chair on a Ph.D. dissertation for the Department of Biology, University of Notre Dame, April 2, 2008

List of publications

1. "Phantom Higgs from Unparticles," A. Delgado, J.R. Espinosa, J.M. No, M. Quiros. CERN-PH-TH-2008-089, IFT-UAM-CSIC-08-23, UAB-FT-644, Apr 2008. 14pp. e-Print: arXiv:0804.4574 [hep-ph]

2. "The Higgs as a Portal to Plasmon-like Unparticle Excitations," A. Delgado, J.R. Espinosa, J.M. No, M. Quiros. IFT-UAM-CSIC-08-09, CERN-PH-TH-2008-033, UAB-FT-639, Feb 2008. 12pp. Published in JHEP04(2008)028. e-Print: arXiv:0802.2680 [hep-ph]

3. "New Physics at the LHC: A Les Houches Report. Physics at Tev Colliders 2007 – New Physics Working Group," G. Brooijmans et al., Feb. 2008. 127 pp. e-Print: arXiv:0802.3715 [hep-ph]

4. "Hunting long-lived gluinos at the Pierre Auger Observatory," L.A. Anchordoqui, A. Delgado, C.A. Garcia Canal, S.J. Sciutto, CERN-PH-TH-2007,120, Oct 2007. 13pp. Phys. Rev. D **77**, 023009 (2008) e-Print: arXiv:0710.0525 [hep-ph]

5. "Unparticles-Higgs Interplay," A. Delgado, J.R. Espinosa and M. Quirós, *JHEP* **0710** (2007) 094

6. "Dynamical Mu Term in Gauge Mediation," A. Delgado, G.F. Giudice and P. Slavich, *Phys. Lett.* **B653** (2007) 424-433

7. "Xtra-Dimensional World(s)," A. Delgado, *J. Phys. Conf. Ser.* **53** (2006) 359

8. "Electroweak Observables in a General 5d Background," A. Delgado and A. Falkowski, *JHEP* **0705** (2007) 097

9. "A New Gauge Mediation Theory," I. Antoniadis, K. Benakli, A. Delgado and M. Quirós, hp-ph/0610265

10. "Split Extended Supersymmetry Fromintersecting Branes," I. Antoniadis, K. Benakli, A. Delgado, M. Quirós and M. Tuckmantel, *Nucl. Phys.* **B744** (2006) 156

11. "The Well-Tempered Neutralino," N. Arkani-Hamed, A. Delgado and G.F. Giudice, *Nucl. Phys.* **B741** (2006) 108

12. "Splitting Extended Supersymmetry," I. Antoniadis, K. Benakli, A. Delgado, M. Quiros and M. Tuckmantel, *Phys.Lett.* **B634** (2006) 302

13. "On the Tuning Condition of Split Supersymmetry," A. Delgado and G.F. Giudice, *Phys.Lett.* **B627** (2005) 155

14. "A Fat Higgs With a Fat Top," A. Delgado and T. Tait, *JHEP* **0507** (2005) 023

15. "Warped Fermions and Precision Tests," M. Carena, A. Delgado, E. Ponton, T. Tait and C. Wagner, *Phys. Rev.* **D71** (2005) 015010

16. "Raising the Higgs Mass in Supersymmetric Models," *Tsukuba 2004, Supersymmetry and unification of fundamental interactions* 757-760

17. "Running Into New Territory in Susy Parameter Space," P. Batra, A. Delgado, D. Kaplan and T. Tait, *JHEP* **0406** (2004) 032

18. "The Higgs Mass Bound in Gauge Extensions of the Minimal Supersymmetric Standard Model," P. Batra, A. Delgado, D. Kaplan and T. Tait, *JHEP* **0402** (2004) 043

19. "RS1, Custodial Isospin and Precision Tests," K. Agashe, A. Delgado, M. May and R. Sundrum, *JHEP* **0308** (2003) 050

20. "Precision Electroweak Data and Unification of Couplings in Warped Extra Dimensions," M. Carena, A. Delgado, E. Ponton, T. Tait and C. Wagner, *Phys. Rev.* **D68** (2003) 035010

21. "Tachyons In a Slice of Ads," A. Delgado and M. Redi, *Phys. Lett.* **B562** (2003) 127

22. "Grand Unification in RS1," K. Agashe, A. Delgado and R. Sundrum, *Ann. Phys.* **304** (2003) 145

23. "Brane Assisted Scherk-Schwarz Supersymmetry Breaking in Orbifolds," A. Delgado, G. von Gersdorff and M. Quirós, *JHEP* **0212** (2002) 002

24. "A Note on Cft Dual of RS Model with Gauge Fields in Bulk," K. Agashe and A. Delgado, *Phys. Rev.* **D67** (2003) 046003

25. "Gauge Coupling Renormalization in RS1," K. Agashe, A. Delgado and R. Sundrum, *Nucl. Phys.* **B643** (2002) 172

26. "Two Loop Higgs Mass in Supersymmetric Kaluza-Klein Theories," A. Delgado, G. von Gersdorff and M. Quirós, *Nucl. Phys.* **B613** (2001) 49

27. "One Loop Higgs Mass Finiteness in Supersymmetric Kaluza-Klein Theories." A. Delgado, G. von Gersdorff, P. John and M. Quirós, *Phys. Lett.* **B517** (2001) 445

28. "Supersymmetry and Finite Radiative Electroweak Breaking from an Extra Dimension," A. Delgado and M. Quirós, *Nucl. Phys.* **B607** (2001) 99

29. "Brane Effects on Extra Dimensional Scenarios: A Tale of Two Gravitons," M. Carena, A. Delgado, J. Likken, S. Pokorsky, M. Quirós and C.E.M. Wagner, *Nucl. Phys.* **B609** (2001) 499

30. "The Lightest Higgs Mass in Supersymmetric Models with Extra Dimensions," A. Delgado and M. Quirós, *Phys. Lett.* **B484** (2000) 355

31. "Electroweak and Flavor Physics in Extensions of the Standard model with Large Extra Dimensions," A. Delgado, A. Pomarol and M. Quirós, *JHEP* **030** (2000) 001

32. "Strong Coupling Unification and Extra Dimensions," A. Delgado and M. Quirós, *Nucl. Phys.* **B559** (1999) 235

33. "Supersymmetry and Electroweak Breaking from Extra Dimensions at the TeV Scale," A. Delgado, A. Pomarol and M. Quirós, *Phys. Rev.* **D60** (1999) 095008

Invited Talks
(International and National Conferences, Seminars, Colloquia)

1. "Higgs-Unparticle Interplay," **seminar**, SLAC Experimental Group, Menlo Park, California, June 17, 2008.

2. "Dynamical mu term in gauge mediation," **seminar**, SLAC Theory Group, Menlo Park, California, June 18, 2008.

3. "Dynamical mu-term in gauge mediation," **seminar**, University of Wisconsin, Madison, April 18, 2008.

4. "Dynamical mu-term in gauge mediation," **seminar**, LHC 2008 Workshop, University of Michigan, January 5-11, 2008.

5. "Dynamical μ term in gauge mediation," **seminar**, Harvard University, Cambridge, Massachusetts, December 4, 2007.

6. "Dynamical μ term in gauge mediation," **seminar**, Boston University, Boston, Massachusetts, December 3, 2007.

7. "Dynamical μ term in gauge mediation," **seminar**, Michigan State University, East Lansing, Michigan, November 13, 2007.

8. "Blackboard, White Chalk and Unparticles," **seminar**, University of Wisconsin, Milwaukee, Wisconsin, October 26, 2007.

9. "The physics behind LHC," **colloquium**, University of Wisconsin, Milwaukee, Wisconsin, October 26, 2007.

10. "Dynamical μ term in gauge mediation," **seminar**, University of Chicago-Enrico Fermi Institute, Chicago, Illinois, October 19, 2007.

Research Interests

My research interests are mainly focused standard model extensions. Those possibilities have been suggested to solve some of the problems of the SM, like the hierarchy between MGUT and MW or the matching of the SM with gravity. The main topic of my Ph.D. thesis was the phenomenology of a five dimensional extension of the minimal supersymmetric standard model, including electroweak symmetry breaking, unification of gauge couplings and the impact of the extra dimension in the electroweak LEP observables.

In these calculations the usual dimensional reduction was used and the theory in 4D is populated with Kaluza-Klein modes. Every even field that lives in 5D consists of a zero mode that is identified with the usual SM-field, plus a tower of KK modes. Dealing with this type of theory has provided me experience with calculations in theories with an infinite number of fields that contribute, for example, to the beta-function, or to the electroweak observables. These techniques are quite similar to those used in Field Theory at Finite Temperature.

During my stay at Johns Hopkins University I have been involved in projects within the Randall-Sundrum scenario. I, with Dr. Agashe and Dr. Sundrum, have performed a thorough analysis of divergences in warped extra dimensions to prove that logarithmic evolution is compatible with these kind of scenarios, leading to a possible realization of high scale unification in extra dimensional theories. Also other phenomenological aspects such as contributions to electroweak observables have been studied. This kind of theories have become the first real competitor to the MSSM. In fact, before our studies it was supposed that any warped scenario will predict KK modes with masses beyond the reach of present and future accelerators, we have been the first ones to show a model with KK masses in the few TeV range. Moreover, since this theories are supposed to be dual to strongly coupled theories, these works have resulted on a resurrection of techni-colour models as a way to explain the hierarchy problem. With Drs. Carena, Ponton, Tait and Wagner of the Chicagoland area I have been studying the impact of brane terms for gauge and fermions in the EW fit, concluding that those terms will make those model more natural regarding the EW observables. The continuation with this line of studies will make part of my future investigation.

I have also studied on extensions of the Higgs sector in the MSSM to enhance the physical mass of the lightest Higgs boson to avoid present bounds and to alleviate the fine-tuning problem existing in the MSSM. This fine-tuning comes from the fact that in order to increase the Higgs mass one wants the sparticle spectrum, specially the stops, to be quite heavy, but these will feed into the Higgs mass parameter with quadratic sensitivity. In fact most of the parameter space of the MSSM has been ruled-out, and only the extreme case with large soft masses and mixings is still valid. Clearly an investigation on ways out is needed. The differential point of these extensions compared to other existing ones like the NMSSM is the use of asymptotically free couplings in such a way that the Higgs mass is proportional to those couplings. This setup ensures a big coupling in the IR independently of the UV value so there is a prediction of a heavy Higgs

regardless of the unknown UV physics and no assumption has to be made to increase that mass.

This last years I have collaborated in a couple of projects related to the so-called "splitsusy" scenario. In this scenario the scalar partners of SM fields of the MSSM are supposed to be much heavier than gauginos and higgsinos. This leaves one of the key ingredients of the MSSM, unification, unchanged whereas all the problems coming from the flavor structure of the scalar masses are solved. Of course, this kind of models do not provide with a solution to the hierarchy problem, but this can be solved in the spirit of the landscape of vacua in string theory. With Prof. Giudice at CERN we have looked on the conditions that a split scenario will put on the RGE evolutions of soft masses and as an ongoing project we are studying a scenario for dark matter where the LSP is a admixture of Bino and Wino. This kind of LSP is quite natural in a situation where scalars and also higgsinos are much heavier than gauginos. It could be a possibility that has not been much explored before. With Prof. Antoniadis, Prof. Benakli and Prof. Quirós we have studied the possibility of splitting EXTENDED supersymmetry, i.e., having an extended N=2 or N=4 gauge sector and getting a low energy theory which agrees with present constrains and predicts unification.

During the last months I have been involved in a couple of projects with a close relation with experimentalist. The first one is the so-called LHC-Olympics, a project started at CERN where both theorist and experimentalists work together to find different algorithms to be able to disentangle between models of physics beyond SM that may have similar signals. Starting with simulations generated by PYTHIA different groups try to find out the best algorithm to correctly identify the model inside the simulation. On the other hand during a visit to Universidad Nacional de la Plata in Argentina a new project has been started to include the effects of physics beyond SM into the montecarlos of the Pierre Auger Observatory for Cosmic Rays. The identification of both the source and the nature of the particle that forms cosmic rays has been a major goal of particle physics for the last 40 years and the possibility that with cosmic rays one could probe exotic physics is really interesting. As can be seen I can work in close collaboration with experimentalist.

I am also right now revisiting the scenario of gauge mediation as supersymmetry breaking mechanism making sure that it passes the bound on the Higgs mass put on by LEP. This breaking is particularly interesting since it predicts flavor blind soft masses so there are no dangerous FCNC. On the one hand a particular scenario for the NMSSM, i.e. the MSSM with a singlet to explain the μ-parameter is being studied and the whole spectrum is calculated putting all the experimental constrains. On the other hand an extension of gauge mediation to include N=2 formalism is being developed with my collaborators. It leads to interesting phenomenology where gauginos are Dirac particles and the Higgs mass does not depend on $\tan\beta$. All of these in order to construct a viable supersymmetric model taking into account all experimental constrains.

In the long term I am interested in the signatures of physics beyond SM that can be found in colliders. One of the possibilities can come from the Higgs sector, it has been widely

study all the signatures of the MSSM, but there could be the possibility that if SUSY is realized at low energies, it is not 'minimal'. Those 'non-minimalities' can affect the Higgs sector and result on different and interesting signals that has not been yet studied in details. As I mentioned before, I have been studying ways of increasing the Higgs mass, in some case these imply enlarging the gauge sector of the MSSM, so there is a prediction of extra gauge bosons like W' and Z', whereas other could contain extra states. In any case the whole Higgs sectors changes leading to interesting and new possibilities, for example the charged Higgs can be the lightest thus producing unique experimental signatures.

Other aspect of the research I will like to pursue and could be particularly relevant for collider physics are theories with extra dimensions. These theories predict that for each field there exists a tower of resonances (KK modes), and these resonances are a distinct signatures to be tested in colliders like the Tevatron. These theories can have an important role in understanding problems relevant to both particle physics and cosmology, and area where there has been very important experimental results coming from the WMAP satellite, such as the dark matter or dark energy. Both of these questions can be addressed in theories with extra dimensions where there are 'new' candidates for dark matter. Other aspects of extra dimensions are the possibility to explain flavor in these scenarios, since there are a lot of flavor experiments nowadays, there could be new results to be explained and extra dimensions open new possibilities to explain fermion masses or mixings, e.g. different locations of different fermions or a non-trivial profile for the Higgs.

I am also interesting in teaching since it is the best way to learn. Preparing lectures forces the teacher to remember some forgotten topics, to find different ways of explaining things and to acquire a language to interact with the alumns. Another important aspect of an university are graduate students, they are the future of our field and working with them is the way of ensuring that there will always be good scientists. For all these reasons I am willing to join a teaching position in your university. Needless to say, I am open to any topics related to the latter or to any other subject in theoretical particle physics in which my knowledge can be valuable.