



Part A. PERSONAL INFORMATION		CV date			16/01/2021
First and Family name	Carlos Muñoz López				
ID number	36037666R		Age	60	
		Researcher ID	L-6654-2013		
Researcher numbers		Orcid code	0000-0001-6345-0023		5-0023

A.1. Current position

Name of University	Universidad Autónoma de Madrid (UAM)				
Department	Física Teórica				
Address and Country	Campus de Cantoblanco, 28049 Madrid, Spain				
Phone number	914974891	E-mail	<u>c.n</u>	c.munoz@uam.es	
Current position	Full Profes	ssor (Catedrático)		From	02/06/2008
Espec. cód. UNESCO	221202, 229001				
Palabras clave	Particle Physics, Supersymmetry, Supergravity, Superstrings, Astroparticle Physics, Dark Matter.				

A.2. Education

PhD (Tesis)	UAM	1986
M.Sc. (Tesina)	UAM	1983
B.Sc. (Licenciado)	UAM	1982

A.3. JCR articles, h Index, thesis supervised...

- 134 papers published: 94 in refereeing journals, 1 as book chapter, 39 proceedings of conferences; 1 paper to be published in refereeing journals.

- <u>Results obtained</u> from the INSPIRE HEP database:

* Total number of citations: 7,473; h Index: 43

* Citations to the 94 papers in refereeing journals: 6,929; Average citations per paper: 74 Average authors per paper: 3; Average citations per author: 2,310

Following the inSPIRE classification, of the above 94 papers are:

Renowned papers (500+ cites): 1.

Famous papers (250-499 cites): 5

Very well-known papers (100-249 cites): 12. Well-known papers (50-99 cites): 20 40% of these 94 papers have more than 50 citations.

<u>Generated on Feb. 2013</u>, there are 498,578 papers in INSPIRE (published). They have 24.5 average citations and only 11% have more than 50 citations.

- 6 sexenios.

- Supervisor of 10 PhD theses (6 finished in the last 10 years); 11 MSc theses; and the work of 13 postdoctoral researchers.

Part B. CV SUMMARY (max. 3500 characters, including spaces)

My research is focused on *Theoretical Physics*. I am interested in the study of the fundamental interactions of Nature, as well as in searching for the theory that unify them. I also want to understand what are dark matter (DM) and dark energy that account for 95% of the Universe. For details, see the site of the group: <u>http://dark.ft.uam.es/papp</u>.

Since 1982, I have been working in *Elementary Particle Physics* beyond the standard model, such as grand unified theories, supersymmetry, supergravity and superstrings, with 50 papers in refereeing journals. I have studied their phenomenology (see e.g. 2, 7 in **C.1**), as well as built standard-like models from superstrings. Since 2005, I am also working in the development of the supersymmetric standard model that I proposed in PRL 97 (2006) 041801, the so-called μ vSSM (see <u>http://dark.ft.uam.es/mununiverse</u>), with the aim of investigating its detectability at the LHC, and with 19 papers published (see e.g. 5, 8 in **C.1**) and another one sent for publication.

In addition, since 2000 I have been researching in *Astroparticle Physics*. My interests are the particle nature of DM in the Universe as well as its detection in underground labs, space-







based detectors, and Cherenkov telescopes. In several particle-physics models, I have proposed DM candidates such as the right sneutrino, and studied other such as the neutralino, or weakly interacting massive particles (WIMPs) in general (see e.g. 1, 4 in **C.1**), with 19 papers published. It is worth noticing that work 4 is in collaboration with members of Fermi-LAT (see http://dark.ft.uam.es/papp/index.php/fermilat). There, we analyzed the annihilation of WIMPs in the inner galaxy. In the context the µvSSM, I have proposed the gravitino and axino as decaying DM candidates, with 6 papers published (see, e.g. 1, 3, 6 in **C.1**). Work 6 is also in collaboration with members of Fermi-LAT. In those papers, we have searched for gamma-ray lines and smooth spectral signatures in the Fermi satellite data, as well as discussed the interest of MeV-GeV gamma-ray telescopes for future searches...

In this field of Astroparticles, I initiated in 2005 the Annual International Conference Series, `The Dark Side of the Universe (DSU)', <u>http://dark.ft.uam.es/dsu</u>. Besides, I managed to organize and coordinate during 2010-17 the project of excellence, Consolider MultiDark, <u>http://www.multidark.es</u>. Currently, I coordinate since 2018 the MultiDark Consolider Network (Red de Excelencia) to continue pushing forward the Spanish position in the field of DM.

Concerning my academic historial, I obtained the Graduate Degree in 1982 at UAM with the Best Undergraduate Student Award (Premio Extraordinario de Licenciatura). I carried out my PhD with a Research Fellowship (FPU grant) during 1983-86, with the last year also working as Teaching Assistant (Profesor Ayudante). During 1986-87, I was Assistant Professor (Profesor Titular Interino). During 1987-90, I was Postdoctoral Fellow at Oxford Univ. (1987-88 with a British Council Fleming Fellowship and 1988-90 with a CSIC Fellowship) and during 1990-92 CERN Fellow. Back in Spain, I was during 1992-93 Assistant Professor at UAM, getting in 1993 a permanent position as Associate Professor (Profesor Titular) of Theoretical Physics and becoming in 2008 Full Professor (Catedrático). I have carried out numerous research visits. Long term: 1996-97 a sabbatical at KAIST, S. Korea, with a Brain Pool Fellowship; 2001-02 at CERN as Scientific Associate; 2004-05 another sabbatical at KAIST as Visiting Professor. Short term (<2 months): 34 visits at institutions and labs. I have also given 128 research talks.

For more details, see: <u>http://dark.ft.uam.es/carlosmunoz</u>

Part C. RELEVANT MERITS (during the last 10 years 2010-19)

C.1. Publications

Despite the heavy bureaucratic duties during the period 2009-17 (acting as Vice-director first, and later as Director of the IFT; Director of the CFTMAT; Coordinator of the Graduate Degree in Physics; and Coordinator of the Consolider project MultiDark, see **C.2** and **C.5**), I managed to publish 31 works: 23 papers in international refereeing journals (with 624 citations) and 8 proceedings of conferences. The publications that I consider most relevant to that period are:

10- Electroweak superpartners scrutinized at the LHC in events with multi-leptons Physics Letters B790 (2019) 176-183 *(11 citations)* Co-authors: I. Lara, D.E. López-Fogliani

9- Looking for the left sneutrino LSP with displaced-vertex searches Physical Review D98 (2018) 075004, 1-17 *(19 citations)* Co-authors: I. Lara, D.E. López-Fogliani, N. Nagata, H. Otono, R. Ruiz de Austri

8- Precise prediction for the Higgs-boson masses in the μvSSM European Physical Journal (EPJ) C78 (2018) 504, 1-33 *(28 citations)* Co-authors: T. Biekotter, S. Heinemeyer

7- Novel signatures for vector-like quarks Journal of High Energy Physics (JHEP) 06 (2017) 095, 1-26 *(29 citations)* Co-authors: J.A. Aguilar-Saavedra, D.E. López-Fogliani





6- Search for 100 MeV to 10 GeV γ-ray lines in the Fermi-LAT data and implications for gravitino dark matter in the μvSSM *(this is a Fermi LAT category II paper)* Journal of Cosmology and Astroparticle Physics (JCAP) 10 (2014) 023, 1-29 *(65 citations)* Co-authors: A. Albert, G.A. Gómez-Vargas, M. Grefe, C. Weniger, E. Bloom, E. Charles, N. Mazziotta, A. Morselli

5- Probing the μ from v supersymmetric standard model with displaced multileptons from the decay of a Higgs boson at the LHC Physical Review D88 (2013) 015009, 1-6 *(39 citations)* C0-authors: P. Ghosh, D.E. López-Fogliani, V. Mitsou, R. Ruiz de Austri

4- Constraints on WIMP annihilation for contracted dark matter in the inner Galaxy with the Fermi-LAT (*this is a Fermi LAT category II paper*)

Journal of Cosmology and Astroparticle Physics (JCAP) 10 (2013) 029, 1-19 *(62 citations)* Co-authors: G.A. Gómez-Vargas, M.A. Sánchez-Conde, J-H. Huh, M. Peiró, F. Prada, A. Morselli, A. Klypin, D.G. Cerdeño, Y. Mambrini

3- CLUES on Fermi-LAT prospects for the extragalactic detection of μvSSM gravitino Dark Matter Journal of Cosmology and Astroparticle Physics (JCAP) 02 (2012) 001, 1-7 *(44 citations)* Co-authors: G.A. Gómez-Vargas, M. Fornasa, F. Zandanel, A.J. Cuesta, F. Prada, G. Yepes

2- Calculable inverse-seesaw neutrino masses in supersymmetry Physical Review D81 (2010) 051701 (R), 1-5 *(46 citations)* Co-authors: F. Bazzocchi, D.G. Cerdeño, J.W.F. Valle

1- Gamma-ray Detection from Gravitino Dark Matter Decay in the μvSSM Journal of Cosmology and Astroparticle Physics (JCAP) 03 (2010) 028, 1-13 *(90 citations)* Co-authors: K.Y. Choi, D.E. López-Fogliani, R. Ruiz de Austri

C.2. Research projects and grants (including the amount of € and if you are the PI)

In the last 10 years, I have been PI of 1 Consolider project, 1 National Network, 4 National projects, and 1 node of a Regional project; Member of 1 National project, 3 Spanish and 2 European Networks, and 1 Bilateral Agreement with INFN. Those that I consider most relevant to that period are:

8- Coordinator of the Red de Excelencia 'MultiDark Consolider Network', FPA2017-90566REDC, 2018-20, 30,000 €. It is formed by the groups of the former Consolider project.

7- Coordinator of the Consolider Project '*Multimessenger Approach for Dark Matter Detection* (*MultiDark*)', CSD2009-00064, 2010-14 (extended until June 2017), 3,800,000 € (including 600,000 € as co-financing UAM). MultiDark was formed by 11 groups belonging to 18 institutions, with 120 researchers.

6- PI of the National Project '*Particles, Astroparticles and* Dark Matter *in the Universe*', PGC2018-095161-B-I00, 2019-21, 96,800 €. Co-PI Miguel A. Sánchez Conde. Research Group at UAM & IFT formed by 8 scientists and 6 PhD students.

5- PI of the National Project '*Particles and AstroParticles in the Universe*', FPA2015-65929-P, 2016-18, 106,722 €. Research Group at UAM & IFT formed by 12 scientists and 4 PhD students.

4- PI of the National Project '*AstroParticles in the Universe*', FPA2012-34694, 2013-15, 121,680 €. Research Group at UAM & IFT formed by 12 scientists and 3 PhD students.

3- Member of the National Project 'Particle Physics in the LHC Era', (PI: E. Álvarez, UAM), FPA2009-09017, 2010-12, 420,475 € + 1 FPI Fellowship.





2- PI of the National Project '*AstroParticles in the Universe*', FPA2009-08958, 2010-12, 151,855 €. Research Group at UAM & IFT formed by 11 scientists and 3 PhD students.

1- PI of the FENO1-UAM Group of the Regional (Community of Madrid) Project 'Phenomenology of the Fundamental Interactions: Fields, Strings and Cosmology, (HEPHACOS)', S2009/ESP-1473, 2010-14, 195,000 €. Research Node at UAM formed by 11 scientists and 8 PhD students.

C.3. Contracts, C.4. Patents : Not applicable

C.5 Management Activities

- * Director of the Instituto de Física Teórica (IFT) UAM-CSIC, 2012-15; Vicedirector, 2009-12; Board Member, 2003-15
- (Severo Ochoa Prize awarded to the IFT in 2012: 4,000,000 € grant for 4 years)
- * Director of the Service Center for IFT & ICMAT (CFTMAT), 2013-15
- * Coordinator of the Graduate Degree in Physics, Faculty of Science, UAM, 2009-13
- * Postgraduate Study Committee Member in Theoretical Physics, UAM, 2009-12
- * UAM Senate Member (Claustral), Jan. 2004-Dec. 2007, Dec. 2009-Nov. 2011

C.6 Outreach Activities

* 7 colloquia in Spain and abroad, 1 hangout, 2 essays on science & society, 2 popular articles, 22 activities in the media (newspapers, radio, TV).

C.7 Academic Activities

- * Undergraduate: Classical Electrodynamics, Mechanics and Waves, Mathematical Methods
- * President of 8 Boards of Examiners for the Ph.D. Degree, and Member of 30 in Spain and Abroad; President of 1 Board for the M.Sc. and Member of 1; President of 2 Boards for the Final Degree Project
- * Member of 8 Selection Committees for Professors in Spain and abroad

C.8 Reviewer

* Referee of 13 International Journals; * Assessor of Scientific Agencies and Projects in Spain and abroad; * Assessor of Univ. and Centers in Spain and abroad for Academic and Research Promotions; * External Referee for Habilitation Defenses in Germany.

C.9 Committee Member

- * Internat. Advisory Board of the Helmholtz Alliance for Astroparticle Physics (HAP), 2012-16
- * Scientific Committee of the International School on Astroparticle Physics (ISAPP), 2005-17
- * Initiator of the Annual Conference Series on Astroparticle Physics, 'The Dark Side of the
- Universe' (DSU); Chairman of the Steering Committee 2005-18; SC Member 2018-
- * Internat. Advisory Comm. of Paris-Saclay Astropart. Symposium, Institute Pascal, 2019-21
- * Member of the Internat. Advisory Comm. of many conferences: TAUP, RICAP, IMFP, etc.

C.10 Organization of Scientific Activities

- * Organizer of 10 Internat. Conf., 2 Internat. Programs in Beijing and S. Korea, etc.
- * Editor of 2 books of proceedings: DSU 2006, AIP; PASCOS 2012, J. Phys.