Marco A. Villena
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Applied Materials Italy SRL
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EDUCATION

2019	Machine Learning course	Stanford University, USA
2015	PhD in Physics Thesis: "*Study, modeling and simulation of RRAM memories*"	University of Granada, Spain
2012	Master of science Thesis: "*Methods and advanced techniques in Physics*"	University of Granada, Spain
2010	Bachelor in Physics	University of Granada, Spain

PROFESSIONAL ACTIVITIES

2019 –		Applied Materials Italy, Italy
2017 – 2018	Postdoctoral fellow (18 months)	Stanford University, USA
2016 – 2019	Postdoctoral researcher Winner of the Suzhou NANO-CIC postdoctoral fellow	Soochow University, China
2016	External researcher collaborator	University of Granada, Spain

SCIENTIFIC ACTIVITIES

2019 –	Member of the technical committee of IPFA 2019 (www.ipfa-ieee.org).
2017 –	Reviewer of Scientific Reports, Nature Publishing group and IEEE Publishing group.
2017	Leader of discussion group. The IEEE IIRW workshop (www.iirw.org).
2017	Chair of organizing committee. *ChinaRRAM workshop,* Suzhou, China (www.chinarram.org).
2017 –	Member, Research Network "Institute of Electrical and Electronics Engineers".
2016 –	Member, Network of Researchers China-Spain. "RICE" (www.ric-e.net).
2013 –	Developer of SIM²RRAM simulation tool (www.marcoavillena.com).

SCIENTIFIC SOFTWARE DEVELOPED

1. **SIM²RRAM**
   Simulation tool for RRAM memories based on Finite-elements methods (www.marcoavillena.com).
2. **Split-DOS for VASP**
   Software for managing and analysis of density of state data calculated by VASP (www.marcoavillena.com).
3. **SCIR** (Structure Classification by Image Recognition)
   Software for automatic classification of crystallographic structures by image recognition techniques (published in paper 1).
4. **AReDeReSC**
   Software for the automatic detection of Reset event during I-V curve measurement on memristor. This software has been designed to work with Keysight B1500A semiconductor parameter analyzer.
   (software for internal use only at Mario Lanza's group, Soochow University)

JOURNAL PAPERS

1. **Marco A. Villena**, Blanka Magyari-Köpe, Yoshio Nishi, Paul C. McIntyre, Mario Lanza, "Effect of IrO_2 spatial distribution on the stability and charge distribution of $Ti_{1-x}Ir_xO_2$ alloys," *Chemistry of Materials 31(21), 8742-8751 (2019)*.

2. Shaochuan Chen, Seyedreza Noori, **Marco A. Villena**, Yuanyuan Shi, Tingting Han, Ying Zuo, MariaPia Pedeferri, Dmitri Strukov, Mario Lanza, Maria Vittoria Diamanti," Memristive Electronic Synapses Made by Anodic Oxidation," *Chemistry of Materials 31(20), 8394-8401 (2019)*.

3. Kaichen Zhu, Xianhu Liang, Bin Yuan, **Marco A. Villena**, Chao Wen, Tao Wang, Shaochuan Chen, Fei Hui, Yuanyuan Shi, Mario Lanza, "Tristate graphene-boron nitride-graphene cross-point memristors," *ACS Applied Materials and Interfaces, 11, 37999-38005 (2019)*.

4. **M. A. Villena**, F. Hui, X. Liang, Y. Shi, B. Yuan, X. Jing, K. Zhu, S. Chen, and M. Lanza, "Variability of metal/h-BN/metal memristors grown via chemical vapor deposition on different materials," *Microelectronics Reliability, 102, 113410 (2019)*.

5. Bin Yuan, Xianhu Liang, Liubiao Zhong, Yuanyuan Shi, Felix Palumbo, Shaochuan Chen, Fei Hui, Xu Jing, **Marco A. Villena**, Lin Jiang, Mario Lanza, "150 nm × 200 nm Cross-Point Hexagonal Boron Nitride Based Memristors," *Advanced Electronic Materials (Accepted Feb. 2019)*.

6. Mario Lanza, H.-S. Philip Wong, Eric Pop, Daniele Ielmini, Dimitri Strukov, Brian C. Regan, Luca Larcher, **Marco A. Villena**, Jianghua J. Yang, Ludovic Goux, Attilio Belmonte, Yuchao Yang, Francesco M. Puglisi, Jinfeng Kang, Blanka Magyari-Köpe, Eilam Yalon, Anthony Kenyon, Mark Buckwell, Adnan Mehonic, Alexander Shluger, Haitong Li, Tuo-Hung Hou, Boris Hudec, Deji Akinwande, Ruijing Ge, Stefano Ambrogio, Juan B. Roldan, Enrique Miranda, Jordi Suñe, Kin Leong Pey, Xing Wu, Nagarajan Raghavan, Ernest Wu, Wei D. Lu, Gabriele Navarro, Weidong Zhang, Huaqiang Wu, Runwei Li, Alexander Holleitner, Ursula Wurstbauer, Max Lemme, Ming Liu, Shibing Long, Qi Liu, Hangbing Lv, Andrea Padovani, Paolo Pavan, Ilia Valov, Xu Jing, Tingting Han, Kaichen Zhu, Shaochuan Chen, Fei Hui, Yuanyuan Shi, "Recommended methods to study resistive switching devices," *Advanced Electronic Materials, 1800143 (2018)*.

7. Fei Hui, Xianhu Liang, Wenjing Fang, Wei Sun Leong, Haozhe Wang, Hui Ying Yang, Yuanyuan Shi, **Marco A. Villena**, Jing Kong, and Mario Lanza, "Uniformity of Multilayer Hexagonal Boron Nitride Dielectric Stacks Grown by Chemical Vapor Deposition on Platinum and Copper Substrates," *In 2018 IEEE International Symposium on the Physical and Failure Analysis of Integrated Circuits (IPFA) (pp. 1-4). IEEE (2018).*

8. Fei Hui, **Marco Villena**, Wenjing Fang, Ang-Yu Lu, Jing Kong, Yuanyuan Shi, Xu Jing, Kaichen Zhu, and Mario Lanza, "Synthesis of large-area multilayer hexagonal boron nitride sheets on iron substrates and its use in resistive switching devices," *2D materials, 5(3), 031011 (2018)*.

9. Bingru Wang, Na Xiao, Chengbin Pan, Yuanyuan Shi, Fei Hui, Xu Jing, Kaichen Zhu, Biyu Guo, **Marco A. Villena**, Enrique Miranda, and Mario Lanza, "Experimental Observation and Mitigation of Dielectric Screening in Hexagonal Boron Nitride Based Resistive Switching Devices," *Cryst. Res. Technol., 53, 1800006 (2018)*.

10. Felix Palumbo, Xianhu Liang, Bin Yuan, Yuanyuan Shi, Fei Hui, **Marco A. Villena**, and Mario Lanza, "Bimodal Dielectric Breakdown in Electronic Devices Using Chemical Vapor Deposited Hexagonal Boron Nitride as Dielectric," *Advanced Electronic Materials, 1700506 (2018)*.

11. Fei Hui, Wenjing Fang, Wei Sun Leong, Tewa Kpulun, Haozhe Wang, Hui Ying Yang, **Marco A. Villena**, Gary Harris, Jing Kong, and Mario Lanza, "Electrical Homogeneity of Large-Area Chemical Vapor Deposited Multilayer Hexagonal Boron Nitride Sheets," *ACS Applied Materials & Interfaces 9(46), 39895-39900 (2017)*.

12. Lanlan Jiang, Yuanyuan Shi, Fei Hui, Kechao Tang, Qian Wu, Chengbin Pan, Xu Jing, Hasan Uppal, Felix Palumbo, Guangyuan Lu, Tianru Wu, Haomin Wang, **Marco Villena**, Xiaoming Xie, Paul McIntyre and Mario Lanza, "Dielectric Breakdown in Chemical Vapor Deposited Hexagonal Boron Nitride," *ACS Applied Materials & Interfaces 9(45), 39758-39770 (2017)*.

13. **Marco A. Villena**, Juan B. Roldán, Francisco Jiménez-Molinos, Enrique Miranda, Jordi Suñé and Mario Lanza, "SIM^{2}RRAM: A physical model for RRAM devices simulation," *Journal of Computational Electronics pp. 1-26 (2017)*.

14. E. Miranda, J. Suñé, C. Pan, **M. Villena**, N. Xiao, and M. Lanza, "Equivalent Circuit Model for the Electron Transport in 2D Resistive Switching Material Systems," *Solid-State Device Research Conference (ESSDERC), 47th European (2017)*.

15. M. Moner Al Chawa, Rodrigo Picos, Juan B. Roldan, Francisco Jimenez-Molinos, **Marco Antonio Villena** and Carol de Benito, "Exploring Resistive Switching based Memristors in the Charge-Flux Domain, a Modeling Approach," *International Journal of Circuit Theory & Applications, 1097-007X (2017)*.

16. Na Xiao, **Marco A. Villena**, Bin Yuan, Shaochuan Chen, Bingru Wang, Marek Eliáš, Yuanyuan Shi, Fei Hui, Xu Jing, Andrew Scheuermann, Kechao Tang, Paul C. McIntyre and Mario Lanza, "Resistive Random Access Memory Cells with a Bilayer TiO_2/SiO_x Insulating Stack for Simultaneous Filamentary and Distributed Resistive Switching," *Advanced Functional Material 1700384 (2017)*.

17. Pan Chengbin, Enrique Miranda, **Marco A. Villena**, Na Xiao, Xu Jing, Xie Xiaoming, Fei Hui, Yuanyuan Shi and Mario Lanza, "Model for multi-filamentary conduction in graphene/hexagonal-boron-nitride/graphene based resistive switching devices using the nonlinear Landauer approach," *2D materials 4, 025099 (2017).*

18. **Marco A. Villena**, Juan B. Roldán, Pedro García-Fernández and Francisco Jiménez-Molinos, "Effects of the extension of conductive filaments, a simulation approach," *Journal of Vacuum Science & Technology B, 35, 01A105 (2017).*

19. **M. A. Villena**, J. B. Roldan, M.B. González, P. González-Rodelas, F. Jimenez-Molinos, F. Campabadal and D. Barrera, "A new parameter to characterize the charge transport regime in Ni/HfO_2/Si-n^+-based RRAMs," *Solid-State Electronics, 118, 56-60 (2016).*

20. **M. A. Villena**, M. B. González, J. B. Roldan, F. Campabadal, F. Jimenez-Molinos, F. M. Gómez-Campos and J. Suñé, "An in-depth study of thermal effects in reset transitions in HfO_2 based RRAMs," *Solid-State Electronics, 111, 47-51 (2015).*

21. F. Jimenez-Molinos, **M. A. Villena**, J. B. Roldan and A. M. Roldan, "A SPICE Compact Model for Unipolar RRAM reset process analysis," *Electron Devices, IEEE Transactions on, 62(3), 955-962 (2015).*

22. **M. A. Villena**, M. B. González, F. Jimenez-Molinos, F. Campabadal, J. B. Roldan, J. Suñe, E. Romera and E. Miranda, "Simulation of thermal reset transitions in resistive switching memories including quantum effects," *J. Appl. Phys. 115, 214504 (2014).*

23. **M. A. Villena**, J. B. Roldan, F. Jimenez-Molinos, J. Suñe, S. Long, E. Miranda and M. Liu, "A comprehensive analysis on progressive reset transitions in RRAMs," *J. Phys. D: Appl. Phys. 47, 205102 (2014).*

24. **M. A. Villena**, F. Jimenez-Molinos, J. B. Roldan, J. Suñe, S. Long, X. Lian, F. Gamiz and M. Liu, "An in-depth simulation study of thermal reset transitions in resistive switching memories," *J. Appl. Phys. 114, 144505 (2013).*

CONFERENCES

1. X. Liang, B. Yuan, Y. Shi, F. Palumbo, S. Chen, F. Hui, X. Jing, **M. A. Villena**, and M. Lanza "150 nm × 200 nm cross point hexagonal boron nitride based memristors with ultra-low currents in high resistive state," *In 2019 Electron Devices Technology and Manufacturing Conference (EDTM), Singapore, 258-260*.

2. Na Xiao, **Marco A. Villena**, Bin Yuan, Shaochuan Chen, Bingru Wang, Marek Eliáš, Yuanyuan Shi, Fei Hui, Xu Jing, Andrew Scheuerman, Kechao Tang, Paul C. McIntyre, and Mario Lanza, "TiO_2/SiO_X bilayer insulating stacks for simultaneous filamentary and distributed resistive switching," *In IIRW 2017, International Workshop*.

3. **Marco A. Villena**, "SIM²RRAM: New physical model and simulator for Resistive RAM," *In China RRAM 2017, International Workshop.*

4. **Marco A. Villena**, Juan B. Roldán and Francisco Jiménez-Molinos, "Threshold voltage of reset: A new parameter to electrical characterization of RRAM devices," *In China RRAM 2017, International Workshop.*

5. Z. He, **Marco A. Villena**, K. Zhu, S. Chen, B. Wang, X. Liang, B. Yuan and M. Lanza, "Au/Ti/TiO_2/Au cross point resistive switching cells: experiment and simulation," *In China RRAM 2017, International Workshop*.

6. Na Xiao, **Marco A. Villena**, Yuanyuan Shi, Xu Jing, Fei Hui and Mario Lanza, "Combination of local and distributed resistive switching in ultra-thin (<2nm) TiO_2 films," *In CDE 2017, 11th Spanish Conference on Electron Devices.*

7. **M. A. Villena**, J. B. Roldan, M. P. García-Fernández and F. Jimenez-Molinos, "Effects of the extension of conductive filaments within the electrodes in RRAMs, a simulation approach," *In Wodim 2016, 19th Workshop on Dielectrics in Microelectronics.*

8. G. González, F. Jimenez-Molinos, **M. A. Villena** and J. B. Roldan, "SPICE simulation of thermal reset transitions in Ni/HfO_2/Si-n^+ RRAMs including quantum effects," *In Wodim 2016, 19th Workshop on Dielectrics in Microelectronics.*

9. R. Picos, J. B. Roldan, M. M. Al Chawa, F. Jimenez-Molinos, **M. A. Villena** and E. Garcia-Moreno, "Exploring ReRRAM-based memristors in the charge-flux domain, a modeling approach," *In IEEE Memristive Systems (MEMRISYS) 2015 International Conference, (pp. 1-2).*

10. **M. A. Villena**, J.B. Roldán, F. Jiménez-Molinos, E. Romera, P. Cartujo-Cassinello, "A comprehensive resistive memory characterization through the analysis of conductive filaments," *15th edition of Trends in Nanotechnology International Conference (TNT2014)*.

FUNDED NATIONAL AND INTERNATIONAL PROJECTS

1. Title: Fabricación, caracterización, simulación, modelado de dispositivos de conmutación resistiva
   Entity: Ministerio de Economía, Industria y Competitividad (Spain)
   From: 01/01/2018 to 31/12/2020
   Researcher in charge: Juan Bautista Roldán Aranda and Francisco Jiménez Molinos
   Funding: 114950 €
   Reference: TEC2017-84321-C4-3-R

TECHNICAL SKILLS

Programming	Matlab, Python, Visual Basic .NET, FORTRAN
Design & Simulation	Ginestra, VASP, PSpice, Virtual NanoLab, FreeCAD
Software tools	Blender, VESTA, CrystalMaker, Gimp 2, Inkscape, Linux (SUSE, Ubuntu), Microsoft Office, LibreOffice