



Politecnico
di Torino

MEMRISYS 2023

Torino, Italy
5-9 Nov 2023

Politecnico di Torino

FINAL PROGRAM

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MEMRISYS 2023 Venue

MEMRISYS 2023 will be held at Politecnico di Torino, 5-9 November 2023.

Welcome Reception and pre-registration:

- SNODO/OGR (Corso Castelfidardo 22, Torino), 18:30 – 20:30

Main entrance of Politecnico di Torino (to Foyer and Aula Magna):

- Corso Duca degli Abruzzi 24

CONFERENCE ROOMS:

- Room Aula Magna, entrance from Corso Duca degli Abruzzi 24
- Room Emma Strada, entrance from Corso Duca degli Abruzzi 24

Conference Opening: 6 November 2023 in the morning, Aula Magna (registration from 8:15 to 9:00)

Program Schedule – Sunday, November 5 / Monday, November 6

Sunday, November 5, 2023							
18:30 - 20:30	Welcom Reception (and pre-registration) - Location: Snodo/OGR (www.snodo.com); Corso Castelfidardo 22, Torino						
Monday, November 6, 2023							
8:15 - 9:00	Registration: Politecnico of Torino, Main Campus, Corso Duca degli Abruzzi, 24						
9:00-9:10	MEMRISYS 2023 welcome: <i>Greetings from the Rector of the Politecnico of Torino (AULA MAGNA)</i>						
9:10-9:20	MEMRISYS 2023 opening: <i>Fernando Corinto, Daniele Ielmini, Carlo Ricciardi, Sabina Spiga</i>						
Plenary session - AULA MAGNA							
9:30 - 10:15	Plenary	Leon Chua	Homemade \$ 10 Chua Corsage Memristor: Workhorse for Poor Man's Biological Neuron			Chair: <i>Fernando Corinto</i>	
10:15-10:45	Coffe break - FOYER AULA MAGNA						
10:45 - 11:30	Plenary	Heike Riel	Quantum Computing – The Path to Quantum Advantage			Chair: <i>Sabina Spiga</i>	
Parallel sessions							
Room AULA MAGNA				Room EMMA STRADA			
11:40 - 13:05	Session 1: Memristive devices and networks; Chairs: <i>A. Sebastian and H. Wu</i>			Session 2: Memristive networks I; Chairs: <i>Andrea Redaelli and Elliot Fuller</i>			
11:40 - 12:05	Invited	188 Damien Querlioz	Towards Self-Powered AI: Harnessing Memristor-Based Bayesian and Binarized Neural Networks for Edge Computing	11:40-12:05	Invited	183 Shinhyun Choi, Hakcheon Jeong, See-On Park, Taehoon Park, Seokho Seo and Seok-man Hong	Development and Application Demonstration of Highly Reliable Memristors
12:05 - 12:20	Oral-S	27 <u>Olga Krestinskaya</u> , Mohammed E. Fouda, Ahmed Eltawil and Khaled N. Salama	Neural Architecture Search for Memristor-based In-memory Computing Applications	12:05-12:30	Invited	156 John Paul Strachan, D. Strukov, M. Hizzani, G. Hutchinson, A. Heittmann, D. Dobrynin, T. Bhattacharya, G. Pedretti, T. Van Vaerenbergh, I. Rozada, F. de Haas and R. Beausoleil	Using memristors for in-memory, mixed analog-digital computing in optimization problems
12:20-12:35	Oral	103 <u>M. Csontos</u> , Y. Horst, N. J. Olalla, U. Koch, I. Shorubalko, A. Halbritter and J. Leuthold	Resolving the dynamics of picosecond time-scale resistive switching	12:30-12:45	Oral	185 Rui Wang, Tuo Shi, Xumeng Zhang, Jinsong Wei, Jian Lu, Jiaxue Zhu, Zuheng Wu, Qi Liu and Ming Liu	Implementing in-situ Self-organizing Maps with Memristor Crossbar Arrays
12:35-12:50	Oral	106 <u>Boris Hudec</u> , Che-Chia Chang and Tuo-Hung Hou	Probing degradation mechanisms of oxide analog memristors by a combination of thin film spectroscopy techniques	12:45-13:00	Oral	31 <u>Tobias Kirchner</u> , Taha Soliman and Luca Parrini	Flexible but precise Analog in-Memory Compute Design with current mode ADCs
12:50-13:05	Oral	145 <u>András Halbritter</u> , A. Nyáry, B. Sánta, L. Pósa and Z. Balogh	Noise spectroscopy of memristive devices: from steady state fluctuations to nonlinear noise diagnostics				
13:05 - 14:30	Lunch break - FOYER AULA MAGNA						
14.30-16:35	Session 3: Memristive networks II; Chairs: <i>Melika Payvand and Ronald Tetzlaff</i>			Session 4: Three-terminal memristors; Chairs: <i>D. Kuzum and Y. van de Burgt</i>			
14:30 - 14:55	Invited	150 Abu Sebastian	Continual learning using neuro-vector symbolic architectures and memristive in-memory computing	14:30 - 14:55	Invited	121 Bilge Yildiz	Time-dependent programming of electrochemical synapses enabled by nonlinear voltage kinetics
14:55 - 15:20	Invited	4 Andrea Redaelli	Embedded PCM: an enabler for IMC in AI accelerators	14:55 - 15:20	Invited	74 Elliot Fuller	More is different: physical computing discovery
15:20 - 15:35	Oral	10 Yubiao Luo and <u>Zhong Sun</u>	Compensation methods for in-memory computing	15:20 - 15:35	Oral	48 <u>Peng Lin</u> , Peng Chen, Fenghao Liu and Gang Pan	Accurate Training of Neural Networks in Electrochemical Memristive Device Arrays
15:35 - 15:50	Oral	136 <u>Piergiulio Mannocci</u> and Daniele Ielmini	In-memory singular value decomposition for next-generation massive MIMO	15:35 - 15:50	Oral	66 <u>Hisashi Inoue</u> , H. Tamura, A. Kitoh, X. Chen, Z. Byambadorj, T. Yajima, Y. Hotta, T. Iizuka, G. Tanaka and I. H. Inoue	Tailoring oxygen diffusion dynamics in three-terminal devices for spiking reservoir computing
15:50-16:05	Oral	86 Seokjin Oh, Rina Yoon, Seungmyeong Cho and <u>Kyeong-Sik Min</u>	Unconventional Computing Memristor Circuits Towards On-Edge Learning	15:50-16:05	Oral-S	16 <u>Himadri Nandan Mohanty</u> , Tohru Tsuruoka, Jyoti Ranjan Mohanty and Kazuya Terabe	Proton-gated synaptic transistors, based on an EBL patterned Nafion electrolyte
16:05 - 16:20	Oral-S	144 <u>Sebastian Werner</u> , <u>Schmid</u> , Z. Balogh, B. Sánta, L. Pósa and A. Halbritter	Noise diagnostics of nanoscale VO ₂ Mott memristor devices	16:05 - 16:20	Oral-S	126 <u>Mila Lewerenz</u> , E. Passerini, B. Cheng, M. Fischer, A. Emboras, M. Luisier, U. Koch and J. Leuthold	Pulsed Atomic-Scale Three-Terminal Memristor
16:20 - 16:35	Oral	53 <u>Woon Hyung Cheong</u> and Kyung Min Kim	Molybdenum-based Stochastic 1T1M device for Homomorphic Encryption Accelerator	16:20 - 16:35	Oral	61 <u>Max Talanov</u>	Memristive CPG simulation
16:40 - 17:40	Round Table: "History of Memristors". Plenary Speakers: Masakazu Aono, Leon Chua, Rainer Waser; Chair: <i>Carlo Ricciardi (EMMA STRADA)</i>						
18:00-20:00	classic music concert (optional)						

Oral-S Student papers are eligible for the **Best Oral Award** and are highlighted in grey

Program Schedule – Tuesday, November 7

Tuesday, November 7, 2023							
8:15 - 9:00	Registration						
Plenary session - AULA MAGNA							
9:00 - 9:45	Plenary	Saptarshi Das	2D Memtransistors for Bio-inspired Computing			Chair: Daniele Ielmini	
9:45 - 10:30	Plenary	Wilfred van der Wiel	Materializing Cognition: Information Processing in Cognitive Matter			Chair: Carlo Ricciardi	
10:30-11:00	Coffe break						
Parallel sessions							
Room AULA MAGNA			Room EMMA STRADA				
Session 5: Neuromorphic and reservoir computing; Chairs: Stephan Menzel and Suin Yi			Session 6: In-materia computing; Chairs: Gianluca Milano and Zdenka Kuncic				
11:00-11:25	Invited	207 Duygu Kuzum	Integration of RRAM Crossbars and Mott ReLU Neurons for Efficient Implementation of Deep Neural Networks in Hardware	11:00-11:25	Invited	7 Simon Brown	Brain-like Computation with Percolating Networks of Nanoparticles
11:25-11:50	Invited	70 Melika Payvand	Structure-function duality in memristive intelligent systems	11:25-11:50	Invited	202 Hirofumi Tanaka	In-sensor AI computing devices by random network of nanomaterials
11:50-12:05	Oral	23 Ayoub Jaafar, Neil Kemp and Ruomeng Huang	Diffusive Memristors-Based Neuromorphic Switching and Reservoir Computing	11:50-12:05	Oral-S	131 Fabio Michieletti, Gianluca Milano and Carlo Ricciardi	Self-organized criticality in memristive nanowire networks
12:05-12:20	Oral-S	192 Carlos Silva, Jonas Deuermeier, Rodrigo Martins and Asal Kizadeh	ZTO-based resistive switching devices for brain-inspired neuromorphic applications	12:05-12:20	Oral-S	25 Sabrina Artmeier, Jonathan Hiltz, Jonathan G. C. Veinot and Marc Tarnow	Single-Nanoparticle Based Memristors for Neuromorphic Computing
12:20-12:35	Oral-S	12 Kaoru Shihata, Daiki Nishioka, Wataru Namiki, Tomoki Wada, Takashi Tsuchiya, Tohru Higuchi and Kazuya Terabe	A Redox-Based Ion-Gating Reservoir, Utilizing (104) Oriented LiCoO ₂ Film and Physical Masking	12:20-12:35	Oral	94 Paolo Milani, Bruno Paroli and Marco Potenza	An Optical Neuromorphic Device for Classification and Pattern Recognition
12:35-12:50	Oral-S	34 Dongkai Guo, Omesh Kapur, Peng Dai, Liudi Jiang, C. H. de Groot and Ruomeng Huang	Reservoir computing using back-end-of-line SiC based memristors	12:35-12:50	Oral-S	98 Francesca Borghi, Giacomo Nadalini, Silvia Bressan and Paolo Milani	In-Materia Adaptive Computing Devices based on Random-Assembled Clusters Network
12:50-13:05	Oral-S	148 Caterina Sbandati, Spyros Stathopoulos, Patrick Foster, Alexander Serb, Shiwei Wang and Themis Prodromakis	RRAM-based processing of Local Field Potentials	12:50-13:05	Oral-S	224 Davide Pilati, Fabio Michieletti, Gianluca Milano and Carlo Ricciardi	Multielectrode characterization of neuromorphic nanowire networks
Lunch break (FOYER AULA MAGNA)							
Steering committee meeting (including lunch): Shannon meeting room (ground floor) - only for the steering committee members							
14:30-16:25	Session 7: Neuromorphic computing I; Chairs: Cheol Seong Hwang			Session 8: Molecular and organic memristors; Chairs: Wilfred van der Wiel and Marc Tarnow			
14:30 - 14:55	Invited	110 Erika Covi	Synergistic Memristive-CMOS Architectures for Energy-Efficient Neuromorphic Edge Computing	14:30-14:55	Invited	216 Yoeri van de Burgt	Hardware implementation of backpropagation using progressive gradient descent
14:55 - 15:10	Oral-S	93 Tongjun Zhang, Li Shao, Ioannis Zelmpeki, Andrew Hector and Ruomeng Huang	Temporal timescale control enabled by mesoporous silica-based memristors	14:55-15:20	Invited	134 Suin Yi, Sreetosh Goswami, Thirumalai Venkatesan and R. Stanley Williams	Versatile Molecular Memristor Crossbars for 32-bit Parallel Adders and Brain-like Deep Learning
15:10- 15:25	Oral	178 Mrinmoy Dutta, Stefano Brivio and Sabina Spiga	Integrative function before and during switching phase in volatile memristors	15:20-15:35	Oral	19 Marco Moors, Irina Werner, Fangshun Yang, Eric Vogelsberg and Kirill Monakhov	Polyoxovanadates as potential molecular multi-level switching elements
15:25 - 15:40	Oral-S	129 M. Payvand, S. D'Agostino, F. Moro, Y. Demirag, G. Indiveri and E. Vianello	Exploitation of Resistive Memories as Delays and Weights in Dendritic Computation for Temporal Pattern Recognition	15:35-15:50	Oral-S	115 Carlos David Prado Socorro, Salvador Cardona Serra and Eugenio Coronado	Data-Driven Chemical Design: Tailoring Properties for Mechanism Comprehension and Optimization of Polymeric Memristive Devices
15:40-15:55	Oral	152 Marcelo Rozenberg, Jiaming Wu, Olivier Schneegans and Kang Wang	Bursting dynamics in a spiking neuron with a memristive voltage-gated channel	15:50-16:05	Oral	125 Silvia Battistoni, Victor Erokhin, Simone Luigi Marasso, Matteo Parmeggiani, Rocco Carcione and Matteo Cocuzza	Exploring printing technologies for the memristive devices realization
15:55 - 16:10	Oral-S	65 Prabana Jettv, Kannan Udaya Mohanan and S Narayana Jammalamadaka	α -Fe ₂ O ₃ -based artificial synaptic RRAM device for pattern recognition using artificial neural networks	16:05-16:20	Oral-S	112 Raquel Martins, Emanuel Carlos and Jonas Deuermeier	Sustainable and cost-effective solution-based metal oxide memristors
16:10 - 16:25	Oral-S	124 T. Nera Török, R. Kövecs, D. Molnár, L. Pósa, G. Molnár, N. Q. Khánh, A. Halbritter and J. Volk	Applying neurodynamic behavior of Mott Insulators for auditory sensing				
16:25-16:50	Coffee break						
16:50-18:45	Session 9: Memristive networks III; Chairs: John Paul Strachan and Alan Ascoli			Session 10: 2D and layered materials; Chairs: Paolo Fantini and Erika Covi			
16:50-17:15	Invited	18 Huaqiang Wu and Jianshi Tang	Towards Memristor-based Versatile Computing-in-Memory Systems with Software-Hardware Co-Development	16:50-17:15	Invited	8 Chanyoung Yoo and Cheol Seong Hwang	Atomic Layer Deposition of Sb ₂ Te ₃ /GeTe superlattice film and its melt-quenching-free phase transition mechanism for phase-change memory
17:15-17:30	Oral	177 Manuel Escudero, Sabina Spiga and Stefano Brivio	A memristor-based chaotic physical reservoir with tunable dynamics	17:15-17:30	Oral	157 M. Farronato, P. P. Tummala, C. Martella, A. Lamperti, A. Molle, C. M. Compagnoni and D. Ielmini	Memtransistors based on few-layer MoS ₂ with ionic and electronic switching for neuromorphic computing
17:30 - 17:45	Oral-S	104 Dongshu Liu, Jérémie Laydevant, Damien Querlioz and Julie Grollier	Unsupervised Equilibrium Propagation	17:30 - 17:45	Oral-S	22 S. Cruces, L. Voelkel, J. Lee, A. Esteki, D. Braun, A. Grundmann, H. Kalisch, M. Heuken, A. Vescan, A. Daus and M. Lemme	Forming-Free Resistive Switching by Lateral Ag Ion Migration in MoS ₂
17:45-18:00	Oral	222 Gianluca Zoppo, Francesco Marrone, Fernando Corinto and Marco Gilli	A nonlinear dynamic approach to equilibrium propagation techniques	17:45-18:00	Oral-S	170 Sara Ghomi, Christian Martella, Carlo Grazianetti and Alessandro Molle	Investigation of resistive switching behavior in the CVD grown 2D Tellurium
18:0-18:15	Oral	153 Philipp Schreyer, Nico Kaiser and Eszter Piros	Substoichiometric conducting HfOx phases as new type of electrode with a built-in oxygen vacancy reservoir for RRAM-applications	18:0-18:15	Oral	194 Catarina Dias, Naveed Mehmood, João Ventura and Harri Lipsanen	Resistive switching in 2D NbSe ₂ for neuromorphic applications
18:15-18:30	Oral	120 A. Gutsche, M. Buczek, Z. Fiedler, S. Siegel, S. Hamsch and R. Dittmann	Area-dependent switching memristive devices for neuromorphic applications	18:15-18:30	Oral-S	42 Lijun Chen and Maria Antonietta Loi	Quasi-2D lead-tin perovskite memory devices fabricated by blade coating
18:30-18:45	Oral-S	122 P. F. Betancur, I. Fernandez-Guillen, C. A. Aranda, M. Vallés-Pelarda, E. C. Mombiona, T. Ripollés, R. Abargues, P. P. Boix.	Perovskite Memristors: a new wave of emerging memories based on Thin-Film Single Cristal	18:30-18:45	Oral-S	193 Henrique Teixeira, Catarina Dias, I. Çaha, L. Francis and João Ventura	Tuning of 2D Ti3C ₂ Tx MXene flakes for neuromorphic applications
18:45-20:30	Poster session 1 (with aperitif and snacks) - FOYER AULA MAGNA (the posters can be hung to the panels at the end of the lunch break)						

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Program Schedule – Wednesday, November 8

Wednesday, November 8, 2023				
Plenary session - AULA MAGNA				
9:00 - 9:45	Plenary	Elisa Vianello	Resistive memory-based concepts for real-time signal processing at the edge	Chair: Sabina Spiga
Parallel sessions				
Room AULA MAGNA			Room EMMA STRADA	
Session 11: Neuromorphic computing II; Chairs: Elisa Vianello and Damien Querlioz			Session 12: Electrochemical metallization cells; Chairs: Ming Liu and Kazuya Terabe	
9:50 - 10:15	Invited	204 Chiara Bartolozzi	Unconventional sensing and perception: towards neuromorphic robots	9:50-10:15 Invited 195
10:15 - 10:30	Oral-S	141 D. Molnár, T. N. Török, R. Kövecs, L. Pósa, P. Balázs, Z. Balogh, G. Molnár, N. J. Olalla, J. Leuthold, J. Volk, M. Csontos and A. Halbritter	Autonomous neural information processing by a dynamical memristor circuit	10:15-10:30 Oral-S 132
10:30 - 10:45	Oral	45 Zhongqiang Wang, Ya Lin, Xiaoning Zhao, Ye Tao, Haiyang Xu and Yichun Liu	Metal Oxide Based Memristors for Neuromorphic Sensory System	10:30-10:45 Oral-S 160
10:45-11:00	Oral	56 Si En Timothy Ng, Natalia Yantara, Arindam Basu and Nripan Mathews	Ion-mediated recombination dynamics in perovskite-based memory light-emitting diodes for neuromorphic control systems	10:45-11:00 Oral 212
11:00-11:15	Oral	219 Adil Malik	Memristive Stochastic Binary Neurons for Solving Optimisation Problems	11:00-11:15 Oral-S 180
11:15-11:40 Coffee break				
Session 13: Valence change memories; Chairs: Gianluca Milano and Stefano Brivio			Session 14: Memristor models, materials and mechanisms; Chairs: Iliia Valov and Paolo Milani	
11:40-12:05	Invited	83 Stephan Menzel	Analytical Modeling of the Electron Conduction in VCM Cells	11:40-12:05 Invited 78
12:05-12:20	Oral	166 Dimitrios Prousalis, Vasileios Ntinias, Ioannis Messaris, Ahmet Samil Demirkol, Alon Ascoli and Ronald Tetzlaff	Dynamics of Memristive Bridge Structures with Valence Change Mechanism (VCM) Devices	12:05-12:20 Oral-S 197
12:20-12:35	Oral-S	174 Johannes Hellwig, Carsten Funck, Hugh Greatorex, Regina Dittmann and Elisabetta Chicca	Resolving the Physical Origin of LRS Relaxation in Valence Change Memory	12:20-12:35 Oral 165
12:35-12:50	Oral	76 Cristian Ferreyra, María José Sánchez, Diego Rubi, Miguel Badillo, Yulei Li, Mónica Acuautila and Beatriz Noheda	Competitive mechanisms in Hafnia-based memristive devices	12:35-12:50 Oral-S 24
12:50-13:05	Oral-S	161 Nils Sommer and Stephan Menzel	Physics-inspired Compact Modeling of the Bilayer Oxide Resistive Switching Cells Based on an Exchange of Oxygen Ions	12:50-13:05 Oral-S 127
13:05-13:20	Oral	189 Vasileios Ntinias, Y. Wang, I. Messaris, V. Rana, S. Menzel, A. Ascoli and R. Tetzlaff	VCM Memristor Model Adaptation to Enable Simulation Time Speed-Up	13:05-13:20 Oral 68
13:20-14:30 Lunch break - Foyer AULA MAGNA				
Session 15: Memristive nanostructures; Chairs: Simon Brown and Hirofumi Tanaka			Session 16: Ferroelectric memristors; Chairs: Stephan Menzel and Georgios Ch. Sirakoulis	
14:30-14:55	Invited	47 Gianluca Milano and Carlo Ricciardi	In materia computing with self-organizing nanowire networks	14:30-14:55 Invited 50
14:55-15:20	Invited	89 Zdenka Kuncic, A. Loeffler, A. Diaz-Alvarez, R. Zhu, J. Shine and T. Nakayama	Spikes, synapses and dynamic memory in memristive nanowire networks	14:55-15:20 Invited 97
15:20-15:35	Oral	84 A. Cultrera, G. Milano, L. Boarino, N. De Leo, C. Ricciardi, K. Bejtka and L. Callegaro	Electrical Resistance Tomography of self-organizing neuromorphic nanowire networks	15:20-15:35 Oral 105
15:35 - 15:50	Oral	155 Katarzyna Bejtka, Marco Allione, Gianluca Milano and C. F. Pirri	In-situ TEM study of breakdown and thermal annealing effects on silver nanowire for memristive applications	15:35-15:50 Oral 62
15:50-16:05	Oral	95 Paolo Milani and Francesca Borghi	Building reliable devices with unreliable components: supersonic cluster beam fabrication of neuromorphic data processing systems	15:50-16:05 Oral-S 196
16:10-17:40 Poster session 2 (with coffee and sweets) - FOYER AULA MAGNA (the posters can be hung to the panels at the end of the lunch break)				
18:00-23:00 All the following events are held at Museo del Risorgimento, Piazza Carlo Alberto 8, TORINO				
18:15-19:15 optional guided tour to Museo del Risorgimento (subjectation to availability and reservation) at 18:15, 18:25, 18:35; free tour at any time from 18:00 to 20:00				
19:15-20:00 Round Table with editors (Museo del Risorgimento, Sala Codici): Ian Forbes (Neuromorphic Computing and Engineering, IOP); Selina La Barbera (Nature Communications, NPG); Matthew Parker (Nature Electronics, NPG); Gaia Tomasello (Advanced Electronic Materials, Wiley); Chair: Carlo Ricciardi				
20:00-23:00 MEMRISYS 2023 dinner (Museo del Risorgimento)				

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Program Schedule – Thursday, November 9

Thursday, November 9, 2023									
Plenary session - AULA MAGNA									
9:00 - 9:45	Plenary	Tuo-Hung (Alex) Hou				Toward practical applications of analog in-memory computing: from AI acceleration to combinatorial optimization	Chair: Daniele Ielmini		
Parallel sessions									
Room AULA MAGNA			Room EMMA STRADA						
9:50-11:00	Session 17: Memristive networks IV; Chair: Qiangfei Xia			Session 18: Memristors and applications I; Chair: Tuo-Hung (Alex) and Ronald Tetzlaff					
9:50 - 10:15	Invited	211	Suhas Kumar	Scalable AI training at the edge using memristors	9:50 - 10:15	Invited	209	Julie Grollier and Frank Alice Mizrahi	Multilayer spintronic neural networks with radio-frequency connections
10:15 - 10:30	Oral-S	69	Daniel Schön and Stephan Menzel	Impact of Thermal Crosstalk in Memristive Crossbar Arrays	10:15 - 10:30	Oral	6	Alberto Riminucci, A. Shumilin, P. Neha, M. Benini, R. Rakshit, M. Singh, L. Gnoli, I. Bergenti and R. Cecchini	Synaptic Time Dynamics in Molecular $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3/\text{Gaq3}/\text{AlOx}/\text{Co}$ Spintronic Devices
10:30-10:45	Oral-S	96	Ziang Chen, X. Zhao, C. Bengel, F. Liu, K. Li, H. Schmidt, S. Menzel and N. Du	Exploiting sneak path effect for assessing functional behaviors in self-rectifying passive crossbar arrays	10:30-10:45	Oral	2	Juan Bisquert	Device physics criteria to make spiking neurons from memristors by ac impedance characteristics
10:45-11:00	Oral-S	71	Onur Toprak, F. Maudet, R. Thewes, C. Dubourdieu and V. Deshpande	Amorphous GaOx based Non-Filamentary Memristive Device with Highly Repeatable Multiple States	10:45-11:00	Oral	100	Jangyong Kim, Deepika Yadav, Spyros Stathopoulos and Themis Prodromakis	Memristive Switching Effect of Planar Metal-Insulator-Metal Capacitors with Micro and Nano Gap
11:00-11:30	Coffe break								
11:30-13:10	Session 19: Phase Change Memories; Chairs: Andrea Redaelli and Suhas Kumar			Session 20: Memristors and applications II; Chair: Frank Mizrahi					
11:30-11:55	Invited	119	Paolo Fantini	Memory technology enabling future computing systems	11:30-11:55	Invited	221	Qiangfei Xia	Memristive Device and Circuits for Radiofrequency Applications
11:55 - 12:20	Invited	205	Stefano Ambrogio, P. Narayanan, A. Okazaki, A. Fasoli, C. Mackin, A. Friz, J. Luquin, A. Chen, H. Tsai and G. W Burr	Accelerating AI with Analog In-Memory Computing	11:55 - 12:10	Oral	44	Dayanand Kumar and Nazeek El-Atab	Negative photo conduction induced by visible light in wide bandgap oxides-based memristor for data storage and photo sensing
12:20-12:35	Oral-S	137	Joseph Pady, Julio Costa, Catherine Ramsdale, Feras Alkhalil, Monica F. Cracium and C. David Wright	GeSbSeTe Phase-Change Materials for Non-Volatile Memory Applications in Flexible Electronics	12:10-12:25	Oral-S	139	K. Portner, L. Bégon-Lours, V. Braglia, T. Zellweger, C. Weilenmann, D. Jubin, D. Falcone, F. Hermann, L. De Angelis, U. Drechsler, A. Olziersky, T. Stecconi, A. La Porta, M. Luisier, B. Jan Offrein and A. Emboras	Co-Integration of an Analog, CMOS-Compatible Electro-Optical Conductive Metal-Oxide/HfO2 Memristor with Si Photonics
12:35-12:50	Oral-S	226	L. Pistolesi, A. Glukhov, A. de Gracia Herranz, M. Lopez-Vallejo, M. Carissimi, M. Pasotti, P. Rolandi, A. Redaelli, I. Muñoz Martín, S. Bianchi, A. Bonfanti, D. Ielmini	Drift compensation in multilevel phase change memory (PCM) for in-memory computing (IMC)	12:25-12:40	Oral-S	108	Till Zellweger, K. Portner, C. Weilenmann, M. Luisier and A. Emboras	An Electro-Optical Memristor Based on Amorphous Germanium
12:50-13:05	Oral	146	László Pósa, Péter Horung, Tímea Nóra Török, Sebastian Werner Schmid, Andrés Halbritter and János Volk	Interplay of Thermal and Electronic Effects in the Mott Transition of Nanosized VO ₂ Phase Change Memory Devices	12:40-12:55	Oral-S	28	Jiayi Li, Haider Abbas, Asif Ali, Xin Ju and Diing Sheng Ang	An HfOx ReRAM Optroinic Reservoir for Image Classification
13:20-14:30	Lunch break - FOYER AULA MAGNA								
14:30-15:15	Plenary talk	Ronald Tetzlaff				Recent insights into multistable memristors	Chair: Fernando Corinto		
15:15-15:30	ECCTD 2023 opening								
15:30-17:00	MEMRISYS 2023 - ECCTD 2023 joint session - AULA MAGNA; Chairs: Marco Gilli								
15:30- 15:55	Invited	26	Nikolay Agudov, Alexander Dubkov, Alexey Mikhaylov, Maria Koryazhkina and Bernardo Spagnolo	Stochastic approach to memristor modeling					
15:55-16:10	Oral	101	Alon Ascoli, Ahmet Samil Demirkol, Ronald Tetzlaff and Leon Chua	Edge of Chaos Behind Yet-Unexplained Phenomena across Neuronal Channels					
16:10-16:25	Oral-S	158	Kailing Song, Fabrizio Bonani, Michele Bonnin, Fernando Corinto, Fabio Traversa, Stefano Brivio and Manuel Escudero	Noise induced oscillation in a memristive circuit					
16:25-16:40	Oral	140	Ahmet Samil Demirkol, Mohamad Moner Al Chawa, Alon Ascoli and Ronald Tetzlaff	Implementation of Compact Chaotic Systems Using the Locally Active 2T1RC Circuit					
16:40-17:00	MEMRISYS 2023 closure (including communication of best poster and oral award)								

Oral-S Student papers are eligible for the Best Oral Award and are highlighted in grey

MEMRISYS 2023 - Torino, Italy, 5-9 November 2023

Poster Session 1

POSTER Session 1 - November 7, 2023

Authors	Title
Rishab Goyal and Ritu Gupta	PHYSICALLY UNCLONABLE FUNCTION USING SCHMITT TRIGGERS
<u>Hongwei Tan</u> and Sebastiaan van Dijken	Dynamic machine vision with retinomorph photomemristor-reservoir computing
<u>Yu Yamaguchi</u> , Daiki Nishioka, Wataru Namiki, Takashi Tsuchiya, Masataka Imura, Yasuo Koide, Tohru Higuchi and Kazuya Terabe	Spoken digit recognition using an electric double layer-based ion-gating reservoir
<u>Zhi Li</u> , Dashan Shang, Rui Bao, Jun Wang, Haoxiong Ren, Woyu Zhang, Fei Wang and Zhongrui Wang	RRAM-based In-Memory Hyperdimensional Computing for Spatial-Temporal Signal Encoding
<u>Lukas Voelkel</u> , Dennis Braun, Melkamu Belete, Satender Kataria, Thorsten Wahlbrink, Ke Ran, Kevin Kistermann, Joachim Mayer, Stephan Menzel, Alwin Daus and Max C. Lemme	Temperature-dependent Current Voltage Measurements in Hexagonal Boron Nitride Threshold Memristors with Nickel Electrodes
<u>Abdulaziz Alshaya</u> , Adil Malik, Andrea Mifsud and Christos Papavassiliou	Fully Passive Selectorless Array Based on 1C1R
<u>Woyu Zhang</u> , Zhi Li, Fei Wang, Yi Li, Jun Wang, Rui Bao, Haoxiong Ren, Zhongrui Wang and Dashan Shang	Fully Binarized RRAM-based Graph Convolutional Network Acceleration
Ishan Madaan, Prisha Singla, Vikram Makhija, Sarvesh Vishwakarma and Taneesha Tandon	Human Personality Prediction Model Using Machine Learning Techniques
<u>Enrique Miranda</u> , Fernando Aguirre, Eszter Piros, Nico Kaiser, Tobias Vogel, Stefan Petzold, Jonas Gehringer, Timo Oster, Klaus Hofmann, Jordi Suñe, Christian Hochberger and Lambert Alff	Recursive formulation of the memdiode model for resistive switching devices
<u>Jeong Hyun Yoon</u> , Young-Woong Song and Jang-Yeon Kwon	Resistive Switching Behavior Improvement of Peptide Material-Based Memristor Device through Al ₂ O ₃ Layer Insertion
<u>Aijaz Lone</u> and Gianluca Setti	Magnetic Domain Wall and Skyrmion Devices -based Neuromorphic Computing
<u>Seung Woo Han</u> and Moo Whan Shin	Stable and uniform resistive switching of multi-stacked structure-based memristor for neuromorphic system
<u>Zachary Heywood</u> , Joshua Mallinson, Ryan Daniels, Matthew Arnold, Philip Bones and Simon Brown	Emulation of Swarming with Percolating Networks of Nanoparticles
<u>Geunyoung Kim</u> and Kyung Min Kim	Threshold Modulative Artificial GABAergic Nociceptor
<u>Taewook Kim</u> , Toviás Vogel and Eszter Piros	Oxide thickness-dependent resistive switching characteristics of Cu/HfO ₂ /Pt ECM devices
<u>Anni Antola</u> , Ilari Angervo, Hannu Huhtinen, Alejandro Schulman and Petriina Paturi	Optimizing Gd _{0.2} Ca _{0.8} MnO ₃ -Based Memristors
<u>Christopher Madden</u> , Dimitra Georgiadou, Firman Simanjuntak and Sujay Kumar Vishwanath	Low-Power Perovskite Memory Devices Based on Coplanar Nanogaps
<u>Ilari Angervo</u> , Anni Antola, Alejandro Schulman, Hannu Huhtinen and Petriina Paturi	The resilience of resistive switching phenomenon against structural deformation in Gd _{1-x} Ca _x MnO ₃ based planar systems
<u>Yongmin Wang</u> , Vasileios Ntinias, Alon Ascoli, Ioannis Messaris, Ronald Tetzlaff, Vikas Rana and Stephan Menzel	Image processing using VCM based Memristor Cellular Nonlinear Networks
<u>Josh Mallinson</u> , Zac Heywood, Ryan Daniels, Matthew Arnold, Phil Bones and Simon Brown	Reservoir Computing with Scale-free Networks of Memristors
<u>Alexandr Marunchenko</u> , Albert Nasibulin, Ivan Scheblykin and Anatoly Pushkarev	Control over Opto-Electronic Synapses in Halide-Perovskite Microcrystals Toward Memristive Laser Generation
<u>Itir Koymen</u> , Ivan De Carlo, Matteo Fretto, <u>Ozgur Bozat</u> and Gianluca Milano	Temperature Dependence of Au/Cr/TiO ₂ /TiO _x /Cr/Au Memristors Exhibiting Quantum Conductance
<u>Aakash Yadav</u> , Dong-Hyeok Lim and Hongsik Jeong	Investigating the polarity dependence of multi-level cell operation in conventional mushroom phase change memory cells
<u>Wooho Ham</u> and Jang-Yeon Kwon	Surface Roughness Engineering for Improvement of Variability of Memristors
<u>Khaled Humood</u> , Alex Serb, Shiwei Wang and Themis Prodromakis	SPIKA: An Energy-Efficient Time-Domain Hybrid CMOS-RRAM Compute-in-Memory Macro for AI Applications
<u>Mi Hyang Park</u> , Ui Yeon Won, Quoc An Vu, Sung Bum Park and Woo Jong Yu	Multi-terminal Floating gate Memristor in van der Waals heterostructures for Unsupervised Learning
<u>Deepika Yadav</u> , Hannah Levene, Spyros Stathopoulos, Jangyong Jangyong Kim and Themis Prodromakis	Memimpedance behaviour of metal-oxide-based Memristor
<u>Naresh Kumar Pendyala</u> , Antonio Guerrero and Juan Bisquert	Inorganic Buffer-layer for Perovskite Memristor with High and Stable Performance
<u>Giuseppe Leonetti</u> , Matteo Fretto, Katarzyna Bejtka, Fabrizio Pirri, Elena Olivetti, Natascia De Leo, Ilia Valov and Gianluca Milano	Resistive switching properties of anodic NbOx-based devices

Student papers are eligible for the **Best Poster Award** and are highlighted in grey

Poster Session 2

POSTER Session 2 - November 8, 2023

Authors	Title
<u>Jordi Suñé</u> , Fernando Aguirre, Mireia Bargalló-González, Francesca Campabadal and Enrique Miranda	Modeling memristors with conductance quantization for SPICE simulation
Tobias Schwarz, Jonas Gehringer, Timo Oster, Eszter Piros, Fernando Aguirre, Lambert Alf, Enrique Miranda, Klaus Hofmann and Christian Hochberger	Impact and Circuit Implications of Defect Memristors in NV-FPGAs
<u>Stefano Brivio</u> , Manuel Escudero, Mauro Di Marco, Mauro Forti, Giacomo Innocenti, Alberto Tesi, Fernando Corinto and Sabina Spiga	Design and implementation of chaotic circuits based on nonvolatile memristor devices
<u>Spyros Stathopoulos</u> , Alex Serb and Themis Prodromakis	TiOx-based RRAM crossbars integrated on a 180 nm BCD process
Yanghao Wang, Ke Yang and Yuchao Yang	High-order sensory processing nanocircuit based on coupled VO ₂ oscillators
Paul-Philipp Manea, Jiaao Yu and John Paul Strachan	Analysis of the Memristor Comparator: A Key Component in Analog Content Addressable Memories
<u>Michele Martemucci</u> , François Rummens, Tifenn Hirtzlin, Elisa Vianello, Adrien F. Vincent and Sylvain Saighi	Exploring Learning Techniques for Edge AI Taking Advantage of NVMs
<u>Alin Panca</u> , Spyros Stathopoulos, Alex Serb and Themis Prodromakis	Automated RRAM characterization on wafer scale for statistical switching behavior and modeling
<u>Xianyue Zhao</u> , Du Nan, Kefeng Li, Ziang Chen, Jan Dellith, Andrea Dellith, Marco Diegel, Daniel Blaschke, Danilo Bürger, Ilona Skorupa, Hans-Jürgen Engelmann, Stephan Menzel, Ilia Polian, Heidemarie Schmidt and Stephan Krüger	Engineering electrode material and fabrication parameters of BiFeO ₃ thin film in memristive device for brain-inspired in-memory computing
<u>Zoltán Balogh</u> , Anna Nyáry, Botond Sánta, Sebastian Werner Schmid, László Pósa and András Halbritter	Exploring the noise map of memristive systems
<u>Marina Sparvoli</u> , Fábio Jorge, Ricardo Rangel, Ronaldo Mansano, Guilherme Lenz E Silva and José Chubaci	Graphene and ITON-based resistive memories for use as a neuronal membrane
Daisy Gogoi, Carsten Wiemann and Claus Michael Schneider	Photo-emission spectroscopy on resistive switching processes in the ferromagnetic oxide La _{0.7} Sr _{0.3} MnO ₃
<u>Guoyang Huang</u> , Chaohan Wang, Zhaoguang Si, Lu Yang, Shiwei Wang, Alexander Serb, Themis Prodromakis and Christos Papavassiliou	A Data-Driven Memristor Model Accounting for Sequences Stimulus Features
<u>Vittorio Fra</u> , Enrico Macii and Gianvito Urgese	Quantized LIF-based Recurrent Spiking Neural Network for on-edge Neuromorphic Human Activity Recognition
Vishal Gupta, Manuel Escudero, Sabina Spiga and Stefano Brivio	Impact of Compliance Increase and Resistance Reading Modes in Program/Verify Algorithm for HfO ₂ -based RRAM Devices
Mohamad Moner Al Chawa, <u>Rodrigo Picos</u> and Ronald Tetzlaff	A Behavioural Compact Model for Programmable Neuromorphic ReRAM Devices
<u>Ioannis Messaris</u> , Ahmet Samil Demirkol, Ronald Tetzlaff, Alon Ascoli, Vasileios Ntinis and Dimitrios Prousalis	High Frequency Response of Volatile Memristors
<u>Emanuele Gemo</u> , Sabina Spiga and Stefano Brivio	Numerical emulation of neuromorphic systems for multi-time scale data processing
<u>Gergő Fehérvári</u> , Zoltán Balogh, Tímea Nóra Török and András Halbritter	Noise tailoring, noise annealing and external noise injection strategies in memristive Hopfield neural networks
<u>Kristina Nikiruy</u> , Seongae Park, Tzvetan Ivanov, Alon Ascoli, Fernando Corinto, Ronald Tetzlaff and Martin Ziegler	Chaotic time series prediction using next generation reservoir computing with memristive devices
Khitem Lahbacha, Fakhreddine Zayer, <u>Sueda Saylan</u> , Baker Mohammad and Antonio Maffucci	Experimental Analysis of HfO ₂ -Based Memristor Devices
<u>Davide Rossetti</u> , Sergio Chibbaro, Cyril Furtlehner and Lionel Mathelin	Machine Learning for Causal Analysis: An Innovative Approach
Mohamad Moner Al Chawa, Daniel Bedau, Ahmet Samil Demirkol, James W Reiner, Derek Stewart, Michael Grobis and Ronald Tetzlaff	A Compact Model of Threshold Switching Devices
<u>Jeongwoo Lee</u> and Hyunchul Sohn	Compositional Dependence of Threshold Switching in La _x Ni _{1-x} O _y Thin Films
<u>Ju-Young Jeong</u> , Yoogeun Han, Jaeyoung Joo and Hyunchul Sohn	Neuromorphic Characteristics of La-doped HfO ₂ Based FTJ Devices
<u>Andreia Silva</u> , Catarina Dias, Ana Teresa Brandão, Carlos Manuel Pereira and João Ventura	Liquid artificial synapses based on copper solutions
<u>Filippo Profumo</u> , Francesca Borghi, Andrea Falqui and Paolo Milani	Memristive planar devices based on a tunable nanostructured Au and ZrOx composite film
<u>Silvia Bressan</u>	Timing dependence on the pulse train characteristics of the electrical activity of a nanostructured metallic memristive network
<u>Gabriel Caballero Catalan</u>	Tailoring MoS ₂ memtransistors by direct nanopatterning
Utkarsh Misra, Vikas K. Sahu, Amit K. Das, Ajimsha R. S. and Pankaj Misra	Compliance Current Controlled Conductance Quantization in Cu/Ta ₂ O ₅ /Pt Memristors
<u>Andrzej Sławek</u> , Lulu Alluhaibi and Konrad Szaciłowski	Neuromorphic devices based on Ni(II)-tetraaza[14]annulene complexes
<u>Gisya Abdi</u> , Tomasz Mazur, Ewelina Kowalewska, Andrzej Sławek and Konrad Szaciłowski	Investigation the Effect of Cationic and Anionic counterparts in Halobismuth(III) Salts in Artificial Synapses
<u>Tomasz Mazur</u> , Gisya Abdi, Ewelina Kowalewska, Andrzej Sławek, Wojciech Wieczorek, Michał Szuwarzyński and Konrad Szaciłowski	Exploring Memristive Behavior and Synaptic Plasticity Across Diverse Architectures: From Nanoparticles to Polymer Brushes and Crystalline Layers

Student papers are eligible for the **Best Poster Award** and are highlighted in grey

Technical Program – Sunday, 5 November

18:30 – 20:30 SNODO/OGR, corso Castelfidardo 22, 10138 Torino
Welcome Reception (and pre-registration) with aperitif

Technical Program – Monday, 6 November

8:15 – 9:00 Politecnico di Torino, Aula Magna, Corso Duca degli Abruzzi, 24
Registrations

9:00 – 9:30 Aula Magna
Welcome and MEMRISYS 2023 opening

Fernando Corinto, *Politecnico di Torino, Italy*

Daniele Ielmini, *Politecnico di Milano, Italy*

Carlo Ricciardi, *Politecnico di Torino, Italy*

Sabina Spiga, *Consiglio Nazionale delle Ricerche – IMM CNR, Italy*

9:30 – 10:15 Aula Magna
Plenary Session

Homemade \$10 Chua Corsage Memristor: Workhorse for Poor Man's Biological Neuron

Leon Chua, *University of California Berkeley*

Chair: Fernando Corinto, Politecnico di Torino

10:15 – 10:45 Foyer Aula Magna
Coffee Break

10:45 – 11:30 Aula Magna
Plenary Session

Quantum Computing – The Path to Quantum Advantage

Heike Riel, *IBM Quantum, IBM Research Europe – Zurich*

Chair: Sabina Spiga, CNR-IMM, Unit of Agrate Brianza, Agrate Brianza (MB), 20864, ITALY

11:40 – 13:05 Aula Magna
Session 1: Memristive devices and networks
Chairs: A. Sebastian and H. Wu

- 11:40 – 12:05** **Towards Self-Powered AI: Harnessing Memristor-Based Bayesian and Binarized Neural Networks for Edge Computing**
Damien Querlioz
Centre de Nanosciences et de Nanotechnologies
- 12:05 – 12:20** **Neural Architecture Search for Memristor-based In-memory Computing Applications**
Olga Krestinskaya¹, Mohammed E. Fouda², Ahmed Eltawil¹ and Khaled N. Salama¹
¹King Abdullah University of Science and Technology
²Rain Neuromorphics Inc.
- 12:20 – 12:35** **Resolving the dynamics of picosecond time-scale resistive switching**
M. Csontos¹, Y. Horst¹, N. J. Olalla¹, U. Koch¹, I. Shorubalko², A. Halbritter³ and J. Leuthold¹
¹Institute of Electromagnetic Fields, ETH Zurich, 8092, Switzerland,
²Transport at Nanoscale Interfaces Laboratory, Empa, 8600, Switzerland
³Department of Physics, Budapest University of Technology and Economics, 1111, Hungary
- 12:35 – 12:50** **Probing degradation mechanisms of oxide analog memristors by a combination of thin film spectroscopy techniques**
Boris Hudec¹, Che-Chia Chang² and Tuo-Hung Hou²
¹Institute of Electrical Engineering, Slovak Academy of Sciences
²Department of Electronics Engineering and the Institute of Electronics, National Yang Ming Chiao Tung University
- 12:50 – 13:05** **Noise spectroscopy of memristive devices: from steady state fluctuations to nonlinear noise diagnostics**
András Halbritter¹, A. Nyáry¹, B. Sánta¹, L. Pósa² and Z. Balogh³
¹Department of Physics, Budapest University of Technology and Economics
²Hungarian Academy of Sciences, Centre for Energy Research, Institute of Technical Physics and Materials Science
³Budapest University of Technology and Economics

11:40 – 13:00 Room EMMA STRADA

Session 2: Memristive networks I

Chairs: Andrea Redaelli and Elliot Fuller

11:40 – 12:05

Development and Application Demonstration of Highly Reliable Memristors

Shinhyun Choi, Hakcheon Jeong, See-On Park, Taehoon Park, Seokho Seo and Seok-man Hong

Korea Advanced Institute of Science and Technology (KAIST)

12:05 – 12:30

Using memristors for in-memory, mixed analog-digital computing in optimization problems

John Paul Strachan^{1,5}, D. Strukov², M. Hizzani¹, G. Hutchinson², A. Heitmann¹, D. Dobrynin¹, T. Bhattacharya², G. Pedretti³, T. Van Vaerenbergh³, I. Rozada⁴, F. de Haas⁴ and R. Beausoleil⁵

¹Peter Grünberg Institute (PGI-14), Forschungszentrum Jülich

²UCSB

³Hewlett Packard Labs, HPE

⁴QBit

⁵RWTH Aachen University

12:30 – 12:45

Implementing in-situ Self-organizing Maps with Memristor Crossbar Arrays

Rui Wang¹, Tuo Shi¹, Xumeng Zhang², Jinsong Wei¹, Jian Lu¹, Jiaxue Zhu¹, Zuheng Wu¹, Qi Liu² and Ming Liu²

¹The Key Laboratory of Microelectronics Devices and Integrated Technology, IMECAS, 100029, China

²The Frontier institute of Chip and System, Fudan University, 200433, China

12:45 – 13:00

Flexible but precise Analog in-Memory Compute Design with current mode ADCs

Tobias Kirchner, Taha Soliman and Luca Parrini

Robert Bosch GmbH

13:05 – 14:30 Foyer AULA MAGNA

Lunch Break

14:30 – 16:35 Aula Magna

Session 3: Memristive networks II

Chairs: Melika Payvand and Ronald Tetzlaff

- 14:30 – 14:55** **Continual learning using neuro-vector symbolic architectures and memristive in-memory computing**
Abu Sebastian
IBM Research - Zurich
- 14:55 – 15:20** **Embedded PCM: an enabler for IMC in AI accelerators**
Andrea Redaelli
STMicroelectronics TR&D
- 15:20 – 15:35** **Compensation methods for in-memory computing**
Yubiao Luo and Zhong Sun
Peking University
- 15:35 – 15:50** **In-memory singular value decomposition for next-generation massive MIMO**
Piergiulio Mannocci and Daniele Ielmini
Politecnico di Milano
- 15:50 – 16:05** **Unconventional Computing Memristor Circuits Towards On-Edge Learning**
Seokjin Oh, Rina Yoon, Seungmyeong Cho and Kyeong-Sik Min
Kookmin Univ.
- 16:05 – 16:20** **Noise diagnostics of nanoscale VO₂ Mott memristor devices**
Sebastian Werner Schmid, Z. Balogh, B. Sánta, L. Pósa and A. Halbritter
Department of Physics, Budapest University of Technology and Economics, 1111, HUNGARY
- 16:20 – 16:35** **Molybdenum-based Stochastic ITIM device for Homomorphic Encryption Accelerator**
Woon Hyung Cheong and Kyung Min Kim
KAIST

14:30 – 16:35 Room EMMA STRADA

Session 4: Three-terminal memristors

Chairs: D. Kuzum and Y. van de Burgt

- 14:30 – 14:55** **Time-dependent programming of electrochemical synapses enabled by nonlinear voltage kinetics**
Bilge Yildiz
Massachusetts Institute of Technology
- 14:55 – 15:20** **More is different: physical computing discovery**
Elliot Fuller
Sandia National Laboratories

- 15:20 – 15:35** **Accurate Training of Neural Networks in Electrochemical Memristive Device Arrays**
Peng Lin, Peng Chen, Fenghao Liu and Gang Pan
Zhejiang University
- 15:35 – 15:50** **Tailoring oxygen diffusion dynamics in three-terminal devices for spiking reservoir computing**
Hisashi Inoue¹, H. Tamura², A. Kitoh¹, X. Chen², Z. Byambadorj², T. Yajima³, Y. Hotta⁴, T. Iizuka², G. Tanaka^{2,5} and I. H. Inoue¹
¹National Institute of Advanced Industrial Science and Technology
²The University of Tokyo
³Kyushu University
⁴University of Hyogo
⁵Nagoya Institute of Technology
- 15:50 – 16:05** **Proton-gated synaptic transistors, based on an EBL patterned Nafion electrolyte**
Himadri Nandan Mohanty¹, Tohru Tsuruoka², Jyoti Ranjan Mohanty¹ and Kazuya Terabe²
¹Indian Institute of Technology Hyderabad, Kandi, Sangareddy, 502285, Telangana, India
²National Institute for Materials Science, Namiki 1-1, Tsukuba, 305-0044, Japan
- 16:05 – 16:20** **Pulsed Atomic-Scale Three-Terminal Memristor**
Mila Lewerenz¹, E. Passerini¹, B. Cheng², M. Fischer¹, A. Emboras³, M. Luisier³, U. Koch¹ and J. Leuthold¹
¹ETH Zurich, Institute of Electromagnetic Fields
²HKUST Guangzhou, Microelectronics Thrust, Function Hub
³ETH Zurich, Integrated Systems Laboratory
- 16:20 – 16:35** **Memristive CPG simulation**
Max Talanov
Institute for Artificial Intelligence R&D, 21102, Serbia

16:40 – 17:40 Room EMMA STRADA

Round Table: "History of Memristors"

Plenary Speakers: Masakazu Aono, Leon Chua, Rainer Waser

Chair: Carlo Ricciardi

18:00 – 20:00 (optional)

Classical Music Concert

Technical Program – Tuesday, 7 November

8:15 – 9:00 Aula Magna
Registration

9:00 – 9:45 Aula Magna
Plenary Session

2D Memtransistors for Bio-inspired Computing

Saptarshi Das, The Pennsylvania State University

Chair: Daniele Ielmini, Politecnico di Milano

9:45 – 10:30 Aula Magna
Plenary Session

Materializing Cognition: Information Processing in Cognitive Matter

Wilfred van der Wiel, BRAINS - University of Twente

Chair: Carlo Ricciardi, Politecnico di Torino

10:30 – 11:00 Foyer AULA MAGNA
Coffee Break

11:00 – 13:05 Aula Magna
Session 5: Neuromorphic and reservoir computing
Chairs: Stephan Menzel and Suin Yi

- | | |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11:00 – 11:25 | Integration of RRAM Crossbars and Mott ReLU Neurons for Efficient Implementation of Deep Neural Networks in Hardware
Duygu Kuzum
University of California San Diego |
| 11:25 – 11:50 | Structure-function duality in memristive intelligent systems
Melika Payvand
Institute of Neuroinformatics, University of Zurich and ETH Zurich |
| 11:50 – 12:05 | Diffusive Memristors-Based Neuromorphic Switching and Reservoir Computing
<u>Ayoub Jaafar</u> ¹ , Neil Kemp ¹ and Ruomeng Huang ²
¹ School of Physics and Astronomy, University of Nottingham
² School of Electronics and Computer Science, University of Southampton |

- 12:05 – 12:20** **ZTO-based resisting switching devices for brain-inspired neuromorphic applications**
Carlos Silva, Jonas Deuermeier, Rodrigo Martins and Asal Kiazadeh
CENIMAT
- 12:20 – 12:35** **A Redox-Based Ion-Gating Reservoir, Utilizing (104) Oriented LiCoO₂ Film and Physical Masking**
Kaoru Shibata¹, Daiki Nishioka¹, Wataru Namiki¹, Tomoki Wada¹, Takashi Tsuchiya¹, Tohru Higuchi² and Kazuya Terabe¹
¹National Institute for Materials Science
²Tokyo University of Science
- 12:35 – 12:50** **Reservoir computing using back-end-of-line SiC based memristors**
Dongkai Guo, Omesh Kapur, Peng Dai, Liudi Jiang, C. H. de Groot and Ruomeng Huang
University of Southampton
- 12:50 – 13:05** **RRAM-based processing of Local Field Potentials**
Caterina Sbandati, Spyros Stathopoulos, Patrick Foster, Alexander Serb, Shiwei Wang and Themis Prodromakis
University of Edinburgh

11:00 – 13:05 Room EMMA STRADA

Session 6: In-materia computing

Chairs: Gianluca Milano and Zdenka Kuncic

- 11:00 – 11:25** **Brain-like Computation with Percolating Networks of Nanoparticles**
Simon Brown
University of Canterbury
- 11:25 – 11:50** **In-sensor AI computing devices by random network of nanomaterials**
Hirofumi Tanaka
Kyushu Institute of Technology
- 11:50 – 12:05** **Self-organized criticality in memristive nanowire networks**
Fabio Michieletti¹, Gianluca Milano² and Carlo Ricciardi¹
¹Politecnico di Torino
²Istituto Nazionale di Ricerca Metrologica
- 12:05 – 12:20** **Single-Nanoparticle Based Memristors for Neuromorphic Computing**
Sabrina Artmeier¹, Jonathan Hiltz², Jonathan G. C. Veinot² and Marc Tornow¹
¹Technical University of Munich
²University of Edmonton

- 12:20 – 12:35** **An Optical Neuromorphic Device for Classification and Pattern Recognition**
Paolo Milani, Bruno Paroli and Marco Potenza
University of Milano
- 12:35 – 12:50** **In-Materia Adaptive Computing Devices based on Random-Assembled Clusters Network**
Francesca Borghi, Giacomo Nadalini, Silvia Bressan and Paolo Milani
University of Edinburgh
- 12:50 – 13:05** **Multielectrode characterization of neuromorphic nanowire networks**
Davide Pilati¹, Fabio Michieletti¹, Gianluca Milano² and Carlo Ricciardi¹
¹Politecnico di Torino
²Istituto Nazionale di Ricerca Metrologica (INRiM)

13:05 – 14:30 Foyer AULA MAGNA
Lunch Break

Steering Committee Meeting (Shannon Meeting Room, DET ground floor, only for steering committee members)

14:30 – 16:35 Aula Magna

Session 7: Neuromorphic computing I
Chairs: Chiara Bartolozzi and Cheol Seong Hwang

- 14:30 – 14:55** **Synergistic Memristive-CMOS Architectures for Energy-Efficient Neuromorphic Edge Computing**
Erika Covi
NaMLab gGmbH
- 14:55 – 15:10** **Temporal timescale control enabled by mesoporous silica-based memristors**
Tongjun Zhang, Li Shao, Ioannis Zeimpekis, Andrew Hector and Ruomeng Huang
University of Southampton
- 15:10 – 15:25** **Integrative function before and during switching phase in volatile memristors**
Mrinmoy Dutta, Stefano Brivio and Sabina Spiga
CNR – IMM, Unit of Agrate Brianza, 20864, Agrate Brianza , ITALY
- 15:25 – 15:40** **Exploitation of Resistive Memories as Delays and Weights in Dendritic Computation for Temporal Pattern Recognition**
M. Payvand¹, S. D'Agostino², F. Moro², Y. Demirag¹, G. Indiveri¹ and E. Vianello²
¹Institute of Neuroinformatics, University of Zurich and ETH Zurich, Switzerland
²CEA-Leti, Université Grenoble Alpes, F-38000, Grenoble, France

- 15:40 – 15:55** **Bursting dynamics in a spiking neuron with a memristive voltage-gated channel**
Marcelo Rozenberg^{1,2}, Jiaming Wu², Olivier Schneegans² and Kang Wang²
¹CNRS
²Université Paris Saclay
- 15:55 – 16:10** **α -Fe₂O₃-based artificial synaptic RRAM device for pattern recognition using artificial neural networks**
Prabana Jetty¹, Kannan Udaya Mohanan² and S Narayana Jammalamadaka¹
¹Indian Institute of Technology Hyderabad, India
²Gachon University, Republic of Korea.
- 16:10 – 16:25** **Applying neurodynamic behavior of Mott insulators for auditory sensing**
T. Nóra Török¹, R. Kövecsi¹, D. Molnár¹, L. Pósa¹, G. Molnár², N. Q. Khánh², A. Halbritter¹ and J. Volk²
¹Department of Physics, Budapest University of Technology and Economics
²Institute of Technical Physics and Materials Science, Centre for Energy Research

14:30 – 16:35 Room EMMA STRADA

Session 8: Molecular and organic memristors

Chairs: Wilfred van der Wiel and and Marc Tornow

- 14:30 – 14:55** **Hardware implementation of backpropagation using progressive gradient descent**
Yoeri van de Burgt
Eindhoven University of Technology
- 14:55 – 15:20** **Versatile Molecular Memristor Crossbars for 32-bit Parallel Adders and Brain-like Deep Learning**
Suin Yi¹, Sreetosh Goswami², Thirumalai Venkatesan³ and R. Stanley Williams¹
¹Texas A&M University
²Indian Institute of Science
³University of Oklahoma
- 15:20 – 15:35** **Polyoxovanadates as potential molecular multi-level switching elements**
Marco Moors, Irina Werner, Fangshun Yang, Eric Vogelsberg and Kirill Monakhov
Leibniz Institute of Surface Engineering (IOM)

- 15:35 – 15:50** **Data-Driven Chemical Design: Tailoring Properties for Mechanism Comprehension and Optimization of Polymeric Memristive Devices**
Carlos David Prado Socorro, Salvador Cardona Serra and Eugenio Coronado
Institute of Molecular Science - University of Valencia
- 15:50 – 16:05** **Exploring printing technologies for the memristive devices realization**
Silvia Battistoni¹, Victor Erokhin¹, Simone Luigi Marasso^{1,2}, Matteo Parmeggiani², Rocco Carcione¹ and Matteo Cocuzza^{1,2}
¹IMEM-CNR
²Chilab–Materials and Microsystems Laboratory,DISAT, Politecnico di Torino
- 16:05 – 16:20** **Sustainable and cost-effective solution-based metal oxide memristors**
Raquel Martins, Emanuel Carlos and Jonas Deuermeier
CENIMAT/i3N Department of Materials Science, NOVA School of Science and Technology (FCT-UNL) and CEMOP/UNINOVA
- 16:25 – 16:50 Foyer AULA MAGNA
Coffee Break
- 16:50 – 18:45 Aula Magna
Session 9: Memristive networks III
Chairs: John Paul Strachan and Alon Ascoli
- 16:50 – 17:15** **Towards Memristor-based Versatile Computing-in-Memory Systems with Software-Hardware Co-Development**
Huaqiang Wu and Jianshi Tang
Tsinghua University
- 17:15 – 17:30** **A memristor-based chaotic physical reservoir with tunable dynamics**
Manuel Escudero, Sabina Spiga and Stefano Brivi
CNR-IMM, Unit of Agrate Brianza
- 17:30 – 17:45** **Unsupervised Equilibrium Propagation**
Dongshu Liu¹, Jérémie Laydevant¹, Damien Querlioz² and Julie Grollier¹
¹CNRS-Thales
²Centre de Nanosciences et de Nanotechnologies
- 17:45 – 18:00** **A nonlinear dynamic approach to equilibrium propagation techniques**
Gianluca Zoppo¹, Francesco Marrone¹, Fernando Corinto¹ and Marco Gilli²
¹Politecnico di Torino
²Department of Electronics - Politecnico di Torino

- 18:00 – 18:15** **Substoichiometric conducting HfOx phases as new type of electrode with a built-in oxygen vacancy reservoir for RRAM-applications**
Philipp Schreyer, Nico Kaiser and Eszter Piros
TU Darmstadt
- 18:15 – 18:30** **Area-dependent switching memristive devices for neuromorphic applications**
A. Gutsche, M. Buczek, Z. Fiedler, S. Siegel, S. Hamsch and R. Dittmann
Forschungszentrum Jülich GmbH
- 18:15 – 18:30** **3D/2D Heterostructure mixed halide perovskite resistance memories enabled by perfluorinated spacer cations with enhanced retention and endurance characteristics**
M. Loizos¹, K. Rogdakis¹, W. Luo², P. A. Gaina², J. V. Milic² and E. Kymakis¹
¹Department of Electrical Computer Engineering, Hellenic Mediterranean University
²Adolphe Merkle Institute, University of Fribourg
- 18:30 – 18:45** **Perovskite Memristors: a new wave of emerging memories based on Thin-Film Single Crystal**
P. F. Betancur¹, I. Fernandez-Guillen¹, C. A. Aranda^{1,2}, M. Vallés-Pelarda², E. C. Momblona¹, T. Ripollés¹, R. Abargues¹, P. P. Boix¹.
¹Institute of Science Materials of the University of Valencia (ICMUV), Spain
²Institute of Advance Materials (INAM) University Jaume I, Castellon, Spain

16:50 – 18:45 Room EMMA STRADA

Session 10: 2D and layered material
Chairs: Paolo Fantini and Erika Covi

- 16:50 – 17:15** **Atomic Layer Deposition of Sb₂Te₃/GeTe superlattice film and its melt-quenching-free phase transition mechanism for phase-change memory**
Chanyoung Yoo and Cheol Seong Hwang
Seoul National University
- 17:15 – 17:30** **Memtransistors based on few-layer MoS₂ with ionic and electronic switching for neuromorphic computing**
M. Farronato¹, P. P. Tummala², C. Martella², A. Lamperti², A. Molle², C. M. Compagnoni¹ and D. Ielmini¹
¹Politecnico di Milano
²CNR-IMM, Unit of Agrate Brianza
- 17:30 – 17:45** **Forming-Free Resistive Switching by Lateral Ag Ion Migration in MoS₂**
S. Cruces¹, L. Voelkel¹, J. Lee¹, A. Esteki¹, D. Braun, A. Grundmann², H. Kalisch², M. Heuken^{2,3}, A. Vescan², A. Daus¹ and M. Lemme^{1,4}
¹Chair of Electronic Devices, RWTH Aachen University
²Compound Semiconductor Technology, RWTH Aachen University
³AIXTRON SE
⁴AMO GmbH, Advanced Microelectronic Center Aachen

- 17:45 – 18:00** **Investigation of resistive switching behavior in the CVD grown 2D Tellurium**
Sara Ghomi, Christian Martella, Carlo Grazianetti and Alessandro Molle
CNR-IMM
- 18:00 – 18:15** **Resistive switching in 2D NbSe₂ for neuromorphic applications**
Catarina Dias¹, Naveed Mehmood², João Ventura¹ and Harri Lipsanen²
¹IFIMUP/U.Porto
²Aalto University
- 18:15 – 18:30** **Quasi-2D lead-tin perovskite memory devices fabricated by blade coating**
Lijun Chen and Maria Antonietta Loi
University of Groningen
- 18:30 – 18:45** **Tuning of 2D Ti₃C₂T_x MXene flakes for neuromorphic applications**
Henrique Teixeira¹, Catarina Dias¹, I. Çaha², L. Francis² and João Ventura¹
¹IFIMUP, Departamento de Física e Astronomia, Faculdade de Ciências, Universidade do Porto
²International Iberian Nanotechnology Laboratory, Portugal

18:45 – 20:30 Foyer AULA MAGNA

Poster session 1 (with aperitif and snacks)

Technical Program – Wednesday, 8 November

9:00 – 9:45 Aula Magna
Plenary Session

Resistive memory-based concepts for real-time signal processing at the edge

Elisa Vianello, CEA Leti

Chair: Sabina Spiga, CNR - IMM, Unit of Agrate Brianza, 20864 Agrate Brianza, Italy

9:50 – 11:15 Aula Magna
Session 11: Neuromorphic computing II
Chairs: Elisa Vianello and Damien Querlioz

- 9:50 – 10:15** **Unconventional sensing and perception: towards neuromorphic robots**
Chiara Bartolozzi
Istituto Italiano di Tecnologia
- 10:15 – 10:30** **Autonomous neural information processing by a dynamical memristor circuit**
D. Molnár¹, T. N. Török², R. Kövecz², L. Pósa², P. Balázs², Z. Balogh², G. Molnár³, N. J. Olalla⁴, J. Leuthold⁴, J. Volk³, M. Csontos⁴ and A. Halbritter²
¹Budapest University of Technology and Economics
²Department of Physics, Budapest University of Technology and Economics
³Institute of Technical Physics and Materials Science, Centre for Energy Research
⁴Institute of Electromagnetic Fields, ETH Zurich
- 10:30 – 11:45** **Metal Oxide Based Memristors for Neuromorphic Sensory System**
Zhongqiang Wang, Ya Lin, Xiaoning Zhao, Ye Tao, Haiyang Xu and Yichun Liu
Key Laboratory for UV Light-Emitting Materials and Technology of Ministry of Education, Northeast Normal University
- 10:45 – 11:00** **Ion-mediated recombination dynamics in perovskite-based memory light-emitting diodes for neuromorphic control systems**
Si En Timothy Ng¹, Natalia Yantara¹, Arindam Basu² and Nripan Mathewst¹
¹Nanyang Technological University
²City University of Hong Kong
- 11:00 – 11:15** **Memristive Stochastic Binary Neurons for Solving Optimisation Problems**
Adil Malik
Imperial College London

9:50 – 11:15 Room EMMA STRADA

Session 12: Electrochemical metallization cells

Chairs: Ming Liu and Kazuya Terabe

- 9:50 – 10:15** **Ohmic memristors – new understandings on the switching mechanism in ReRAM devices**
Schaochuan Chen¹, Zheng Yang², Heinrich Hartmann³, Astrid Besmehn³, Yuchao Yang² and Iliia Valov³
¹RWTH-Aachen university
²Peking University
³Forschungszentrum Juelich
- 10:15 – 10:30** **Variability-Aware Modeling of Electrochemical Metallization Memory Cells**
Rana Walied Ahmad¹, Rainer Waser^{2,3}, Florian Maudet⁴, Onur Toprak⁴, Catherine Dubourdieu^{4,5} and Stephan Menzel¹
¹JARA-Fit and Peter Grünberg Institute (PGI-7), Forschungszentrum Jülich GmbH, D-52425, Germany
²PGI-7, Forschungsz. Jülich GmbH, D-52425, Germany
³Inst. of Mater. in EE and IT II, RWTH Aachen, D-52056, Germany
⁴QM-IFOX, Helmholtz-Zentrum Berlin für Materialien und Energie, D-14109, Germany
⁵Phys. Chemistry, FU Berlin, D-14195, Germany
- 10:30 – 10:45** **Morphological modelling of the formation and dissolution of the metallic filament in cation-based RRAMs**
Francesco Vaccaro^{1,2}, Stefano Brivio¹, Simona Perotto³, Aurelio Giancarlo Mauri², Mrinmoy Dutta¹ and Sabina Spiga¹
¹CNR - IMM, Unit of Agrate Brianza
²Dipartimento di Matematica, Politecnico di Milano
³MOX, Dipartimento di Matematica, Politecnico di Milano
- 10:45 – 11:00** **Quantum Computation Enabling Circuits utilizing CBRAM Devices**
I.-A. Fyrigos¹, I. Chatzipaschalis¹, E. Tsipas¹, T. P. Chatzinikolaou¹, R.-E. Karamani¹, N. Vasileiadis², P. Dimitrakis² and Georgios Ch. Sirakoulis¹
¹Department of Electrical and Computer Engineering, Democritus University of Thrace
²Institute of Nanoscience and Nanotechnology, NCSR “Demokritos”
- 11:00 – 11:15** **From memdiodes to memristors: Resistive switching mechanisms of perovskite-based devices**
Noushin Rasti, Philip Calado and Piers R F Barnes
Imperial College London

11:15 – 11:40 Foyer Aula Magna

Coffee Break

11:40 – 13:20 Aula Magna

Session 13: Valence change memories

Chairs: Gianluca Milano and Stefano Brivio

- 11:40 – 12:05** **Analytical Modeling of the Electron Conduction in VCM Cells**
Stephan Menzel
Forschungszentrum Juelich
- 12:05 – 12:20** **Dynamics of Memristive Bridge Structures with Valence Change Mechanism (VCM) Devices**
Dimitrios Prousalis, Vasileios Ntinias, Ioannis Messaris, Ahmet Samil Demirkol, Alon Ascoli and Ronald Tetzlaff
Technische Universität Dresden - TU Dresden
- 12:20 – 12:35** **Resolving the Physical Origin of LRS Relaxation in Valence Change Memory**
Johannes Hellwig¹, Carsten Funck¹, Hugh Greatorex², Regina Dittmann¹ and Elisabetta Chicca²
¹Peter Grünberg Institute (PGI 7), Forschungszentrum Jülich GmbH, Wilhelm-Johnen-Straße, 52428 Jülich
²Bio-Inspired Circuits and Systems Lab, Zernike Institute for Advanced Materials, University of Groningen, Netherlands
- 12:35 – 12:50** **Competitive Mechanisms in Hafnia-based Memristive Devices**
Cristian Ferreyra¹, María José Sánchez¹, Diego Rubil, Miguel Badillo², Yulei Li², Mónica Acuautla² and Beatriz Noheda²
¹INN
²RuG
- 12:50 – 13:05** **Physics-inspired Compact Modeling of the Bilayer Oxide Resistive Switching Cells Based on an Exchange of Oxygen Ions**
Nils Sommer and Stephan Menzel
Peter Grünberg Institut 7, Forschungszentrum Jülich
- 13:05 – 13:20** **VCM Memristor Model Adaptation to Enable Simulation Time Speed-Up**
Vasileios Ntinias¹, Y. Wang², I. Messaris¹, V. Rana², S. Menzel², A. Ascoli¹ and R. Tetzlaff¹
¹Technische Universität Dresden
²Forschungszentrum Jülich GmbH

11:40 – 13:20 Room EMMA STRADA

Session 14: Memristor models, materials and mechanisms
Chairs: Ilia Valov and Paolo Milani

- 11:40 – 12:05** **Ionic Nanoarchitectonics to Enhance Memristive and Neuromorphic Technology**
Kazuya Terabe, Takashi Tsuchiya and Tohru Tsuruoka
National Institute for Materials Science (NIMS)
- 12:05 – 12:20** **Local Fading Memory of a Nonvolatile Memristor from Forschungszentrum Jülich**
Alon Ascoli¹, Nicolas Schmitt¹, Ioannis Messaris¹, Ahmet Samil Demirkol¹, Stephan Menzel², Rana Vikas² and Ronald Tetzlaff¹
¹TU Dresden
²FZJ
- 12:20 – 12:35** **Gradual and multi-state resistive switching in oxygen-engineered yttria-based OxRAM**
Eszter Piros¹, S. Petzold¹, F. Aguirre², J. Gehringer³, T. Oster⁴, K. Hofmann⁴, J. Sune², C. Hochberger³, E. Miranda² and L. Alff¹
¹Advanced Thin Film Technology, Institute of Materials Science, Technische Universität Darmstadt
²Departament d'Enginyeria Electrònica, Universitat Autònoma de Barcelona
³Computer Systems Group, Department of Electrical and Information Engineering, Technische Universität Darmstadt
⁴Integrated Electronic Systems, Department of Electrical and Information Engineering, Technische Universität Darmstadt
- 12:35 – 12:50** **Analog Conductive Metal Oxide-HfO₂ ReRAM artificial synapses for neuromorphic computing: physical modelling and stack optimization**
D. F. Falcone¹, S. Menzel², T. Stecconi¹, Y. Popoff¹, A. La Porta¹, M. Sousa¹, B. Jan Offrein¹ and V. Bragaglia¹
¹IBM Research - Europe
²PGI-7 Forschungszentrum Jülich
- 12:50 – 13:05** **Sn Alloying to Improve Memristive Device Performance**
Elias Passerini¹, M. Lewerenz¹, M. Csontos¹, N. J. Olalla¹, K. Keller¹, J. Aeschlimann², F. Xie³, A. Emboras², X. Zhang¹, M. Fischer¹, Y. Fedoryshyn¹, M. Luisier², T. Schimmel³, U. Koch¹ and J. Leuthold¹
¹ETH Zurich, Institute of Electromagnetic Fields
²ETH Zurich, Integrated Systems Laboratory
³KIT, Institute of Applied Physics
- 13:05 – 13:20** **3D/2D Heterostructure mixed halide perovskite resistance memories enabled by perfluorinated spacer cations with enhanced retention and endurance characteristics**
M. Loizos¹, K. Rogdakis¹, W. Luo², P. A. Gaina², J. V. Milic² and E. Kymakis¹
¹Department of Electrical Computer Engineering, Hellenic Mediterranean University
²Adolphe Merkle Institute, University of Fribourg

13:20 – 14:30 Foyer AULA MAGNA

Lunch Break

14:30 – 16:05 Aula Magna

Session 15: Memristive nanostructures

Chairs: Simon Brown and Hirofumi Tanaka

- 14:30 – 14:55** **In materia computing with self-organizing nanowire networks**
Gianluca Milano¹ and Carlo Ricciardi²
¹Istituto Nazionale di Ricerca Metrologica
²Politecnico di Torino
- 14:55 – 15:20** **Spikes, synapses and dynamic memory in memristive nanowire networks**
Zdenka Kuncic¹, A. Loeffler², A. Diaz-Alvarez³, R. Zhu¹, J. Shine¹ and T. Nakayama³
¹University of Sydney
²Cortical Labs
³NIMS
- 15:20 -15:35** **Electrical Resistance Tomography of self-organizing neuromorphic nanowire networks**
A. Cultrera¹, G. Milano², L. Boarino², N. De Leo², C. Ricciardi³, K. Bejtka⁴ and L. Callegaro¹
¹Quantum Metrology and Nanotechnologies, INRiM Istituto Nazionale di Ricerca Metrologica, 10135 Torino, Italy
²Advanced Materials Metrology and Life Sciences, INRiM Istituto Nazionale di Ricerca Metrologica, 10135 Torino, Italy
³Department of Applied Science and Technology, Politecnico di Torino, 10129 Torino, Italy
⁴Center for Sustainable Future Technologies, Istituto Italiano di Tecnologia, 10144 Torino, Italy
- 15:35 – 15:50** **In-situ TEM study of breakdown and thermal annealing effects on silver nanowire for memristive applications**
Katarzyna Bejtka¹, Marco Allione¹, Gianluca Milano² and C. F. Pirri¹
¹Department of Applied Science and Technology, Politecnico di Torino, 10129 Torino, Italy
²Advanced Materials Metrology and Life Sciences, INRiM Istituto Nazionale di Ricerca Metrologica, 10135 Torino, ITALY
- 15:50 – 16:05** **Building reliable devices with unreliable components: supersonic cluster beam fabrication of neuromorphic data processing systems**
Paolo Milani and Francesca Borghi
University of Milano

14:30 – 16:05 Room EMMA STRADA

Session 16: Ferroelectric memristors

Chairs: Stephan Menzel and Georgios Ch. Sirakoulis

- 14:30 – 14:55** **Towards organic monolayer ferroelectric tunnel junctions**
Marc Tornow
TU Munich
- 14:55 – 15:20** **First Demonstration of 9-Mb HZO-based FeRAM Chip: From Device to Chip Perspective**
Ming Liu, Jianguo Yang and Qing Lu
Institute of Microelectronics, Chinese Academy of Sciences
- 15:20 -15:35** **Ferroelectric Field-Effect Transistor Based on Amorphous Gallium Oxide Films for Back-End-of-Line Integration**
Thanh Luan Phan, Charlotte van Dijck and Catherine Dubourdieu
Helmholtz-Zentrum Berlin für Materialien und Energie GmbH
- 15:35 – 15:50** **Ferroelectric synapses made of epitaxial Hf_{0.5}Zr_{0.5}O₂/SrTiO₃- δ on silicon**
N. Siannas¹, C. Zacharaki¹, P. Tsipas¹, D. J. Kim², W. Hamouda², C. Dubourdieu² and Athanasios Dimoulas¹
¹National Center for Scientific research DEMOKRITOS
²Helmholtz - Zentrum Berlin, Berlin für Materialien und Energie
- 15:50 – 16:05** **Ternary Addition Based on Neural Network Using Ferroelectric Tunnel Junctions**
S. Hosseinzadeh¹, S. Lancaster², Z. Yu³, T. Mikolajick², S. Slesazek² and D. Fey¹
¹Friedrich-Alexander University Erlangen-Nürnberg
²NamLab GmbH, 01187 Dresden, Germany
³Peter Grunberg Institute, Forschungszentrum Jülich, Germany

16:10 – 17:40 Foyer AULA MAGNA

Poster Session 2 (with coffee and sweets)

All the following events are held at Museo del Risorgimento,

Piazza Carlo Alberto 8, TORINO

18:15 – 19:15 Museo del Risorgimento, Piazza Carlo Alberto 8, TORINO

Optional Guided Tour to Museo del Risorgimento (subject to availability and reservation) at 18:15; Free tour anytime from 18:00 to 20:00

19:15 – 20:00 Museo del Risorgimento, Sala Codici

Round Table with Editors: Ian Forbes (Neuromorphic Computing and Engineering, IOP); Selina La Barbera (Nature Communications, NPG); Matthew Parker (Nature Electronics, NPG); Gaia Tomasello (Advanced Electronic Materials, Wiley);
Chair: Carlo Ricciardi

20:00 – 23:00 Museo del Risorgimento

MEMRISYS DINNER

Technical Program – Thursday, 9 November

9:00 – 9:45 Aula Magna
Plenary Session

Toward practical applications of analog in-memory computing: from AI acceleration to combinatorial optimization

Tuo-Hung (Alex) HOU, National Yang Ming Chiao Tung University

Chair: Daniele Ielmini, Politecnico di Milano

9:50 – 11:00 Aula Magna
Session 17: Memristive networks IV
Chair: Qiangfei Xia

- 9:50 – 10:15** **Scalable AI training at the edge using memristors**
Suhas Kumar
Sandia National Labs
- 10:15 – 10:30** **Impact of Thermal Crosstalk in Memristive Crossbar Arrays**
Daniel Schön and Stephan Menzel
Peter Grünberg Institute (PGI-7), Forschungszentrum Jülich GmbH, 52425 Jülich, Germany
- 10:30 – 10:45** **Exploiting sneak path effect for assessing functional behaviors in self-rectifying passive crossbar arrays**
Ziang Chen¹, X. Zhao¹, C. Bengel², F. Liu³, K. Li¹, H. Schmidt¹, S. Menzel³ and N.Du¹
¹Institute for Solid State Physics, Friedrich Schiller University Jena, 07743
²Institute of Materials in Electrical Engineering and Information Technology, RWTH Aachen University, 52074
³Peter Grünberg Institut (PGI-7), Forschungszentrum Juelich GmbH, Wilhelm-Johnen-Strasse, Juelich, 52428
- 10:45 – 11:00** **Amorphous GaOx based Non-Filamentary Memristive Device with Highly Repeatable Multiple States**
Onur Toprak^{1,2}, F. Maudet¹, R. Thewes², C. Dubourdieu^{1,3} and V. Deshpande¹
¹Helmholtz-Zentrum Berlin für Materialien und Energie, 14109, Germany
²Technische Universität Berlin, 10587, Germany
³Freie Universität Berlin, 14195, Germany

9:50 – 11:00 Room EMMA STRADA

Session 18: Memristors and applications I
Chair: Tuo-Hung (Alex) and Ronald Tetzlaff

- 9:50 – 10:15** **Multilayer spintronic neural networks with radio-frequency connections**
Julie Grollier and [Frank Alice Mizrahi](#)
CNRS, Thales, Université Paris Saclay
- 10:15 – 10:30** **Synaptic Time Dynamics in Molecular La_{0.7}Sr_{0.3}MnO₃/Gaq₃/AlO_x/Co Spintronic Devices**
[Alberto Riminucci](#)¹, A. Shumilin², P. Neha¹, M. Benini¹, R. Rakshit¹, M. Singh¹, L. Gnoli¹, I. Bergenti¹ and R. Cecchini¹
¹CNR-ISMN
²Jožef Stefan Institute
- 10:30 – 10:45** **Device physics criteria to make spiking neurons from memristors by ac impedance characteristics**
Juan Bisquert
INAM-Universitat Jaume I
- 10:45 – 11:00** **Memristive Switching Effect of Planar Metal-Insulator-Metal Capacitors with Micro and Nano Gap**
[Jangyong Kim](#), Deepika Yadav, Spyros Stathopoulos and Themis Prodromakis
The University of Edinburgh

11:00 – 11:30 Foyer AULA MAGNA

Coffee Break

11:30 – 13:05 Aula Magna

Session 19: Phase change memory
Chairs: Andrea Redaelli and Suhas Kumar

- 11:30 – 11:55** **Memory technology enabling future computing systems**
Paolo Fantini
Micron Technology Inc.
- 11:55 – 12:20** **Accelerating AI with Analog In-Memory-Computing**
[Stefano Ambrogio](#), P. Narayanan, A. Okazaki, A. Fasoli, C. Mackin, A. Friz, J. Luquin, A. Chen, H. Tsai and G. W Burr
IBM Research
- 12:20 – 12:35** **GeSbSeTe Phase-Change Materials for Non-Volatile Memory Applications in Flexible Electronics**
[Joseph Pady](#)¹, Julio Costa², Catherine Ramsdale², Feras Alkhalil², Monica F. Craciun¹ and C. David Wright¹
¹University of Exeter
²Pragmatic Semiconductor

- 12:35 – 12:50** **Drift compensation in multilevel phase change memory (PCM) for in-memory computing (IMC)**
L. Pistolesi¹, A. Glukhov¹, A. de Gracia Herranz², M. Lopez-Vallejo², M. Carissimi³, M. Pasotti³, P. Rolandi³, A. Redaelli³, I. Muñoz Martín¹, S. Bianchi¹, A. Bonfanti¹, D. Ielmini¹
¹Politecnico di Milano
²Universidad Politécnica de Madrid
³STMicroelectronics
- 12:50 – 13:05** **Interplay of Thermal and Electronic Effects in the Mott Transition of Nanosized VO₂ Phase Change Memory Devices**
László Pósa¹, Péter Hornung¹, Tímea Nóra Török², Sebastian Werner Schmid², András Halbritter² and János Volk¹
¹Institute of Technical Physics and Materials Science, Centre for Energy Research
²Department of Physics, Institute of Physics, Budapest University of Technology and Economics
- 11:30 – 13:10 Room EMMA STRADA
Session 20: RF and optoelectronic memristors
Chair: Frank Mizrahi
- 11:30 – 11:55** **Memristive Device and Circuits for Radiofrequency Applications**
Qiangfei Xia
Department of Electrical and Computer Engineering, University of Massachusetts Amherst, U.S.A
- 11:55 – 12:10** **Negative photo conduction induced by visible light in wide bandgap oxides-based memristor for data storage and photo sensing**
Dayanand Kumar and Nazek El-Atab
King Abdullah University of Science and Technology
- 12:10 – 12:25** **Co-Integration of an Analog, CMOS-Compatible Electro-Optical Conductive Metal-Oxide/HfO₂ Memristor with Si Photonics**
K. Portner¹, L. Bégon-Lours², V. Bragaglia², T. Zellweger¹, C. Weilenmann¹, D. Jubin², D. Falcone², F. Hermann², L. De Angelis², U. Drechsler², A. Olziersky², T. Stecconi², A. La Porta², M. Luisier¹, B. Jan Offrein² and A. Emboras¹
¹ETH Zürich
²IBM Research-Zurich
- 12:25 – 12:40** **An Electro-Optical Memristor Based on Amorphous Germanium**
Till Zellweger, K. Portner, C. Weilenmann, M. Luisier and A. Emboras
ETH Zürich
- 12:40 – 12:55** **An HfO_x ReRAM Optronic Reservoir for Image Classification**
Jiayi Li¹, Haider Abbas¹, Asif Ali¹, Xin Ju² and Diing Shenp Ang¹
¹Nanyang Technological University
²Agency for Science, Technology, and Research (A*STAR)

13:20 – 14:30 Foyer AULA MAGNA
Lunch Break

14:30 – 15:15 Aula Magna
Plenary Session

Recent insights into multistable memristors

Ronald Tetzlaff, Technische Universität Dresden

Chair: Fernando Corinto, Politecnico di Torino

15:15 – 15:30
ECCTD 2023 Opening

15:30 – 17:00 Aula Magna
MEMRISYS 2023 - ECCTD 2023 joint session - AULA MAGNA
Chairs: Marco Gilli and Rodrigo Picos

15:30 – 15:55

Stochastic approach to memristor modeling

Nikolay Agudov¹, Alexander Dubkov¹, Alexey Mikhaylov¹, Maria Koryazhkina¹ and Bernardo Spagnolo²

¹Lobachevsky University of Nizhny Novgorod

²Università di Palermo and CNISM

15:55 – 16:10

Edge of Chaos Behind Yet-Unexplained Phenomena across Neuronal Channels

Alon Ascoli¹, Ahmet Samil Demirkol¹, Ronald Tetzlaff¹ and Leon Chua²

¹TU Dresden

²University of California Berkeley

16:10 – 16:25

Noise induced oscillation in a memristive circuit

Kailing Song¹, Fabrizio Bonani², Michele Bonnin², Fernando Corinto², Fabio Traversa³, Stefano Brivio⁴ and Manuel Escudero⁴

¹IUSS University School for Advanced Studies, Pavia

²Politecnico di Torino, Dipartimento di Elettronica e Telecomunicazioni

³Memcomputing Inc

⁴Consiglio Nazionale delle Ricerche, Istituto per la Microelettronica e Microsistemi

16:25 – 16:40

Implementation of Compact Chaotic Systems Using the Locally Active 2TIRC Circuit

Ahmet Samil Demirkol^{1,2}, Mohamad Moner³, Al Chawa³, Alon Ascoli³ and Ronald Tetzlaff²

¹IEE-GE

²Technical University of Dresden

³TU Dresden

16:40 – 17:00

MEMRISYS 2023 Closure (including communication of best poster and oral award)