

WORKSHOP ON “MEMRISTIVE DEVICES AND NEUROMORPHIC APPLICATIONS”

Date: 28 Nov, 2014

Place: Univ. of Zurich, Irchel Campus, Zurich, Switzerland

Organized by

Swiss CAS/ED Chapter and

IBM Research Zurich

TITLE OF EVENT:

IEEE Swiss Memristive Devices and Neuromorphic Applications Workshop 2014

NAME AND FULL DETAILS OF PROPOSERS:

Dr. Shih-Chii Liu and Prof. Tobi Delbruck
Chair and Secretary of IEEE Swiss CAS/ED Chapter
Institute of Neuroinformatics,
University of Zurich and ETH Zurich, Switzerland

TOTAL NUMBER OF PARTICIPANTS:

75 -80 participants (including speakers)

DESCRIPTION:

The first IEEE Swiss Memristive Devices and Neuromorphic Applications workshop (<http://www.ieee.ch/chapters/cas-ed/cas-ed-news/2014-11-27/>) took place at the Irchel Campus, University of Zurich on 28.11.2014. The workshop was co-sponsored by the IEEE CAS Outreach program, IEEE Swiss CAS/ED Chapter, and IBM Research Zurich. Eight experts from different institutions in Europe and in Switzerland presented their recent work on advances in memristive devices such as phase change memory, memristor device physics, neuromorphic chips, memristor device models, and the potential applications of memristors in deep neural networks. The workshop concluded with a lively apero combined with a dozen posters and demos. The workshop had over 75 registered participants from various institutes and companies in Switzerland and Europe.

The primary aim of the workshop was to enable discussion of open technical problems and application opportunities of memristors, and their role in neuromorphic computing. Resistive memory devices also known as "memristors" are being actively researched to address the widening gap in performance between storage and the rest of the computing system. There is also a potential for such devices to serve simultaneously as both memory and logic, or even as components of a neuromorphic computing hardware based on brain architecture. The investigation of the use of these devices in a host of applications in science and technology are currently being explored.

We brought together a unique group of professionals working in the area of memristors and memristive computing in Switzerland, thus promoting visibility in these areas to the engineering community and to academia. The schedule was as follows:

PROGRAM

- 10.15 - 10.30 Introduction to history of workshop**, acknowledgement of sponsorship from IEEE CAS Outreach Initiative, IEEE Swiss CAS/ED Chapter, IBM Research Zurich, and the Institute of Neuroinformatics.
- 10.30 - 11.00 Abu Sebastian**, IBM RESEARCH - Zurich "**Nanoscale Phase Change Devices: Multi-level Storage and Beyond**"
- 11.00 - 11.30 Martin Salinga**, RWTH AACHEN, GERMANY "**Phase Change Materials for Neuro-Computing**"
- 11.45 - 12.15 Ronald Tetzlaff**, TECHNISCHE UNIVERSITAET, DRESDEN "**Dynamic behaviour of memristor circuits**"
- 12.15 - 12.45 Daniele Ielmini**, POLITECNICO MILANO, MILAN "**Stochastic learning and communication in a 2-transistor/1-resistor synapse based on a HfO2 memristor**"
- 14.00- 14.30 Julie Grollier**, UNITÉ MIXTE DE PHYSIQUE CNRS/THALES, "**Purely electronic memristors: Spin Torque and Ferroelectric Synapses**"
- 14.30- 15.00 Giacomo Indiveri**, INSTITUTE OF NEUROINFOMATICS, ZURICH "**Integrating memristive devices in neuromorphic architectures**"
- 15.30- 16.00 Olivier Bichler**, CEA, LIST, GRENOBLE "**Implementing Deep Neural Networks with Non Volatile Memories**"
- 16.00- 16.30 Jennifer Rupp**, ETH ZURICH "**Materials design in oxide memristors: From defect transport kinetics to new storage and logic devices**"

POSTER/DEMOS

Live demonstrations and posters were offered after the talks, during the workshop apero.

Poster title	Author list	Organization
New Strained Memristive Oxide Switch Concepts: Materials and Devices	Sebastian Schweiger, Markus Kubicek, Felix Messerschmitt, Jennifer L.M. Rupp	ETH Zurich Dept. of Materials Electrochemical Materials
Memristor Kinetics and Diffusion Characteristics for Mixed Anionic-Electronic SrTiO _{3-δ} Bits: The Memristor-based Cottrell Analysis Connecting Material to Device Performance	Felix Messerschmitt, Markus Kubicek, Sebastian Schweiger, Jennifer L.M. Rupp	Electrochemical Materials, ETH Zürich
Heterogeneous integration of ReRAM crossbars in 180nm CMOS BeOL process	J. Sandrini, M. Thammasack, T. Demirci, P.-E. Gaillardon, D. Sacchetto, G. De Micheli, Y. Leblebici	Microelectronic Systems Laboratory - EPFL
Gradual resistance modulation in HfO _x -based memristive devices for neuromorphic applications	Stefano Brivio, Erika Covi, Marco Fanciulli and Sabina Spiga* *sabina.spiga@mdm.imm.cnr.it	CNR-IMM, Laboratorio MDM
The Plasmonic Memristor: a Latching Optical Switch	C. Hoessbacher, Y. Fedoryshyn, A. Emboras, D. Hillerkuss, C. Hafner, J. Leuthold	ETH Zurich

Filamentary Switching: synaptic plasticity through device volatility	S. La Barbera, D. Vuillaume, and F. Alibart	Institut d'Electronique, Microélectronique et Nanotechnologies, UMR-CNRS 8520
Memristor based Stochastic Neurons	Rawan Naous Maruan Al Shedivat Gert Cauwenberghs Khaled Nabil Salama	King Abdullah University of Science and Technology Kaust
Effect of Oxygen engineering on resistive switching in HfO2 based RRAM Devices grown by MBE	S. U. Sharath, J. Kurian, E. Hildebrandt, P. Komissinskiy, T. Bertaud, C. Walczyk, P. Calka, T. Schroeder and L. Alff	Advanced Thin Film Technology, Institute for Materials Science, Technische Universität Darmstadt, Germany
Memristor-based stochastic Neuron	Rawan Naous Maruan Al shedivat Gert Cauwenberghs Khaled Nabil Salma	King Abdullah University of Science & Technology (Kaust)
Memristive ReRAM models for beyond memory applications	E. Linn, A. Siemon, R. Waser, S. Menzel	RWTH Aachen University

FINANCIAL REPORT:

Expense Items	Amount (SFr)
Travel Costs for Out-of-Town Speakers	2360.62
Printing, supplies for coffee breaks	187.05
Lunch, apero food	3096.00
Total	5643.67
Registration Fees	-1842.60
Total	3801.07

PHOTOS (MORE ON WEBSITE):

Workshop website: <http://www.ieee.ch/chapters/cas-ed/cas-ed-news/2014-11-27/>



LIST OF PARTICIPANTS

Last Name	First Name	Affiliation	IEEE #
Invited Speakers			
Bichler	Olivier	CEA LIST	-
Grollier	Julie		-
Ielmini	Daniele	Politecnico di Milano	41603127
Indiveri	Giacomo	INI	991455
Rupp	Jennifer	ETHZ	-
Salinga	Martin	Aachen University	-
Sebastian	Abu	IBM	41498503
Tetzlaff	Ronald	TU Dresden	3076379

Attendees			
Abel	Stefan	IBM	-
Achandy	Sherine Rose	INI	-
Alibart	Fabien	IEMN-CNRS	-
Ambrogio	Stefano	Politechnico Milano	92979913
Ascoli	Alon	TU Dresden	-
Balatti	Simone	Politechnico Milano	92673225
Binas	Jonathan	INI	-
Borg	Mattias	IBM	92495602
Boschung	Patrick	Konplan AG	-
Brooks	Roger	IEEE	6450530
Corradi	Federico	INI	92705213
Emboras	Alexandros	ETHZ	-
Fompeyrine	Jean	IBM	-
Gomez	Andres	IIS ETHZ	93126461
Gurkaynak	Frank	ISL ETHZ	-
Heinz	Frederik	Synopsys	90503354
Hössbacher	Claudia	IEF ETHZ	-
Kinali	Attila	-	41426098
Koelmans	Wabe	IBM	-
Korobko	Roman	ETHZ	-
Krebs	Daniel	IBM	-
Kubicek	Markus	ETHZ	-
La Barbera	Selina	Univ. Lille	-
Le Gallo	Manuel	IBM	-
Lebrecht	Daniel	Uni Genf	-
Lee	Kwang Jin	Samsung Electronics	-
Linares Barranco	Alejandro	INI	41635038
Linn	Eike	IWE Aachen	92455373
Lochbaum	Alexander	IEF ETHZ	-
Marchiori	Chiara	IBM	92869013
Marukame	Takao	EPFL	-
Mayr	Christian	INI	92343657
Messerschmitt	Felix	ETHZ	-
Moselund	Kirsten	IBM	41497496
Mostafa	Hesham	INI	-
Nair	Manuel	Manchester	-
Naous	Rawan	KAUST	-
Novelli	Leonardo	UZH	-
Nyffeler	Clemens	EPFL LSM	92210321
Pantazi	Angeliki	IBM	80283619
Perez Pena	Fernando	INI	92959963
Reita	Carlo	CEA	-
Rosset	Christophe	IBM	-
Salamin	Yannik	IEF ETHZ	92617064
Sandrini	Jury	EPFL	-
Schenk	Benz	UZH	-
Schmidt	Voker	IBM	-
Schmitt	Rafael	ETHZ	-
Attendees (continued)			
Schweiger	Sebastian	ETHZ	-
Sorbian	Wojciech	CERN	-
Spiga	Sabina	CNR-IMM, Laboratorio MDM	92755580
Thammasack	Maxime	EPFL	-
Tuma	Tomas	IBM	90611532
Vallero	Alessandro	EPFL	-
Wang	Zhongqiang	Politechnico Milano	-
Wichmann	Giselher	ETHZ	93104508
Wosniak	Stanislaw	IBM	-
Zapp	Sören	INI	-

Helpers			
Chien	Chen-Han	INI	92476178
Klein	Philippe	INI	-
Liu	Hongjie	INI	?
Moeys	Diederik	INI	92236754
Neil	Dan	INI	-
Staff			
Aguilar	Kathrin	INI	-
Schumacher	Simone	INI	-
Organizers			
Delbruck	Tobi	INI	41257850
Eleftheriou	Evangelos	IBM	4262465
Liu	Shih-Chii	INI	41484157