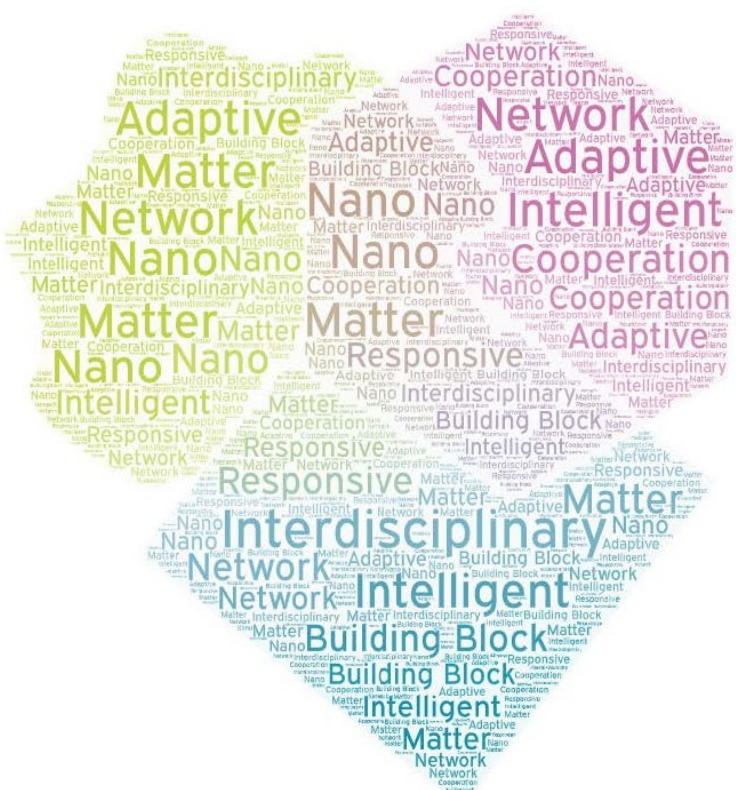
Westfälische Wilhelms-Universität Münster

Center for Soft Nanoscience

CRC 1459 Intelligent Matter

CRC 1459 Colloquium

19th May 2022 2022 | 3:00pm
Münster, Germany



Booklet of Abstracts

Program

3:00 pm

Giacomo Indiveri

Chair: Martin Salinga

ETH Zurich, Switzerland

Neuromorphic Intelligence: Electronic Circuits for Emulating Neural Processing Systems and Their Application to Pattern Recognition

3:45 pm

Elisabetta Chicca

Chair: Martin Salinga

University of Groningen, NL

Exploiting Temporal Dynamics in Neuromorphic Sensing

4:30 pm

Christian Pester

Chair: Bart Jan Ravoo

Penn State University, USA

Design of Advanced Functional Surfaces using Oxygen-Tolerant Photopolymerization

5:20 pm

Networking with Beer & Pretzels

Please see our website www.uni-muenster.de/SFB1459/events for updates or contact crc1459@uni- muenster.de if you have any questions!

Speakers

Prof. Dr. Giacomo Indiveri

Institute of Neuroinformatics
University of Zurich and ETH Zurich
Zurich, Switzerland

Giacomo Indiveri is a Professor at the Institute of Neuroinformcatics at the University of Zurich and ETH Zurich, Switzerland. He obtained an M.Sc. degree in electrical engineering and a Ph.D. degree in computer science from the University of Genoa, Italy. Indiveri was a post-doctoral research fellow in the Division of Biology at Caltech and at the Institute of Neuroinformatics of the University of Zurich and ETH Zurich. In 2006 he attained the “habilitation” in Neuromorphic Engineering at the ETH Zurich Department of Information Technology and Electrical Engineering. He won an ERC Starting Grans on “Neuromorphic processors” in 2011 and an ERC Consolidator Grant on neuromorphic cognitive agents in 2016. His research interests lie in the study of neural computation, with particular interest in spike-based learning and selective attention mechanisms, and in the hardware implementation of real-time sensory-motor systems using analog/digital neuromorphic circuits and emerging VLSI technologies.

Neuromorphic Intelligence: Electronic Circuits for Emulating Neural Processing Systems and Their Application to Pattern Recognition

Giacomo Indiveri, ETH Zurich, Switzerland

Artificial Intelligence (AI) and deep learning algorithms have demonstrated impressive results in a wide range of applications. However, they still have serious shortcomings for use cases that require real-time processing of sensory data and closed-loop interactions with the real-world, in uncontrolled environments. Neuromorphic Intelligence (NI) aims to mitigate this shortcoming by developing ultra-low power electronic circuits and radically different brain-inspired in-memory computing architectures.
In this presentation I will present examples of NI circuits that exploit the physics of their devices to directly emulate the biophysics of real neurons, and I will demonstrate applications of NI processing systems to use cases that require low power, local processing of the sensed data, and that cannot afford to connect to the cloud for running AI algorithms.

Prof. Dr. Elisabetta Chicca

Chair of Bio-Inspired Circuits and Systems (BICS)
Zernike Institute for Advanced Materials
CogniGron - Groningen Cognitive Systems and Materials Center
University of Groningen
Groningen, The Netherlands

Elisabetta Chicca obtained a "Laurea" degree (M.Sc.) in Physics from the University of Rome 1 "La Sapienza", Italy in 1999 with a thesis on CMOS spike-based learning. In 2006 she received a Ph.D. in Natural Science from the Swiss Federal Institute of Technology Zurich (ETHZ, Physics department) and in Neuroscience from the Neuroscience Center Zurich (Switzerland). E. Chicca has carried out her research as a Postdoctoral fellow (2006-2010) and as a Group Leader (2010-2011) at the Institute of Neuroinformatics (University of Zurich and ETH Zurich) working on the development of neuromorphic signal processing and sensory systems. Between 2011 and 2020 she led the Neuromorphic Behaving Systems research group at Bielefeld University (Germany). In 2021 she established the Bio-Inspired Circuits and Systems group at the University of Groningen (Netherlands). Her current interests are in the development of CMOS models of cortical circuits for brain-inspired computation, learning in spiking CMOS neural networks and memristive systems, bio-inspired sensing (vision, touch, olfaction, audition) and motor control.

Exploiting Temporal Dynamics in Neuromorphic Sensing

Elisabetta Chicca, University of Groningen, NL

Biological and artificial agents strongly rely on sensing to effectively interact with other agents and the environment. Independently of the sensory modality, the time difference between two events can carry important information. Well studied examples are motion flow and sound source localization computed on the basis of time of flight and interaural time difference respectively. We propose a spiking Time Difference Encoder (sTDE) compatible with any event-based neuromorphic sensor. The sTDE encodes the time difference between two incoming events in the number of spikes and the inter-spike-intervals within a short burst. Its response properties are very well suited for the exploitation of temporal dynamics in neuromorphic sensing. The application of this novel computation module on a variety of real-word sensory tasks will be presented in this talk.

Prof. Dr. Christian Pester

Department of Chemical Engineering,
Department of Chemistry (Courtesy),
Department of Materials Science and Engineering (Courtesy),
The Pennsylvania State University,
University Park, PA 16802, USA

Christian Pester received his Diploma in Polymer and Colloidal Chemistry from the University of Bayreuth (Germany), before working for Prof. Alexander Böker at the DWI - Leibniz Institute for Interactive Materials (RWTH Aachen University, Germany). In 2013, he graduated summa cum laude and was awarded the Borcher's Medal for his Ph.D. thesis on block copolymers in electric fields. He was then hosted by Profs. Edward J. Kramer and Craig J. Hawker at the University of California, Santa Barbara (USA) as an Alexander-von-Humboldt Feodor-Lynen Postdoctoral Fellow. Christian Pester is currently the Thomas K. Hepler Early Career Professor in Chemical Engineering at the Pennsylvania State University and holds courtesy appointments in the Chemistry Department and the Materials Science and Engineering Department. Christian Pester is an elected member-at-large of the ACS PMSE division, awardee of the NSF CAREER award, and ACS PMSE Young Investigator 2022.

Design of Advanced Functional Surfaces using Oxygen-Tolerant Photopolymerization

Christian Pester, Penn State University, USA

The covalent attachment of polymers has emerged as a powerful strategy for the preparation of multi-functional surfaces. Patterned, surface-grafted polymer brushes provide spatial control over a variety of physical properties and allow for fabrication of 'intelligent' substrates which selectively adapt to their environment. This presentation describes recent advances in our group in using photolithography to produce topographically and chemically patterned polymer brush surfaces via surface-initiated (SI) photoinduced electron/energy transfer (PET) reversible addition–fragmentation chain transfer (RAFT) polymerization. Using this oxygen tolerant approach, organic light emitting diodes (OLEDs), anti-microbial surfaces, and anti-fogging coatings are engineered to highlight facile pathways towards advanced functional surfaces. Oxygen tolerance, mild reaction conditions, and the use of visible light make this approach user-friendly in its application for the design of patterned and functional organic thin films.