JUNE 2022

CONNECTIONS

LATEST NEWS AND UPDATES FROM SEMICONDUCTOR RESEARCH CORPORATION

MRS Spring '22 Meeting Features 2030 Decadal Plan for Semiconductors Panel Discussion and Poster Session

Early last month, scientists and engineers from around the world converged in Honolulu, Hawaii, to share groundbreaking materials research and engage in deep and insightful dialogue about the future of our industry. SRC was proud to host a panel discussion and poster session that featured some of the top industry leaders as well as our next generation of innovators.

The panel discussion was moderated by Emma Pawliczak of Binghamton University and included panelists Robert D. Clark of Tokyo Electron Limited, Steffen Hellmold of Twist Bioscience, Marie Krysak of Intel, and Matthew J. Marinella of Arizona State University. The panel discussed the five seismic shifts outlined in SRC's 2030 Decadal Plan for Semiconductors and dove into the current and future research needs in semiconductor materials and processes, including new generations of transistors, 3D integration, advanced packaging, and DNA data storage and more.

At the poster session, SRC scholars had a chance to show off their research on next-generation semiconductors. The diversity of experience, ideas, and viewpoints was an excellent representation of the industry-leading work that is being done by our scholars in collaboration with our industry members. SRC is grateful to work with such a dedicated community to help drive the advancement of the semiconductor industry. Special thanks to SRC Chief Scientist Victor Zhirnov and SRC's Mary Nichols for their efforts to make the event a success for all involved. Until next time, Hawaii!

READ ON FOR MORE NEWS AND UPDATES!

Semiconductor Research Corporation

SRC and IIT Sign MOU to Grow R&D Investments in India

Photo credit: @SemiconIndia

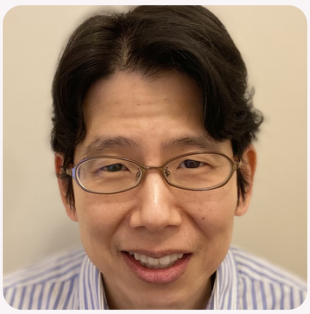
SRC CEO Dr. Todd Younkin and Prof. Subhasis Chaudhuri of The Indian Institute of Technology (IIT), Bombay, signed an MoU to bring together SRC's industry experts and India's R&D talent to create an industry-driven world-class R&D program.

IIT is a "premier Institute of National importance with major thrusts in education and innovation in technology, circuits, and systems." The partnership is co-funded by the Ministry of Electronics and Information Technology, an executive agency of the Union Government of the Republic of India.

Marconnet named ASME Fellow

CHIRP researcher Amy Marconnet has been elected a Fellow of The American Society of Mechanical Engineers. Dr. Marconnet researches heat transfer, energy conversion, and materials science at Purdue University. Congratulations, Dr. Marconnet!

New Research Uses Ring Oscillators to Solve N-hard Problems



nCore and AI HW researcher Dr. Chris Kim's work on "A 1,968-node coupled ring oscillator circuit for combinatorial optimization problem solving" has been published in the journal Nature Electronics. The team of researchers at the University of Minnesota's Department of Electrical and Computer Engineering used a 1,968-node King's graph ring oscillator array to achieve "up to 95% accuracy for randomly generated combinatorial optimization problems."

Kim is the 2016 recipient of the SRC Technical Excellence Award and has served as an advisor to students participating in the NSF REU program.

Georgia Tech Researchers to Present at VLSI

Georgia Tech professors Asif Khan, Arijit Raychowdhury, Shimeng Yu, and Suman Datta will present their SRC-sponsored research at the 2022 IEEE Symposium on VLSI Technology and Circuits in Hawai'i.

Datta and Yu will be giving short courses on Monolithic and Heterogeneous Integration and Advances in Application-Specific Computing Systems and Technologies. As part of the Monolithic and Heterogeneous Integration course, Muhannad Bakir will present on "2.5D and 3D Polylithic Integration Technologies."

SRC Semiconductor Research Corporation

Novel METEOR Project Published

Automotive Electronics researchers at the University of Maryland, College Park, released the first major traffic data set from India which can be used to greatly improve autonomous driving in select traffic scenarios. This annotated data set tackles the complex traffic patterns of India, including diversity of weather, day/night time, high-density urban traffic, and rural areas with unmarked roads. Learn more about METEOR.

JUMP ASCENT Paper Featured in SCIENCE

Researchers from UC Berkeley, Lawrence Berkeley National Laboratory, and Argonne National Laboratory published the paper "Emergent ferroelectricity in subnanometer binary oxide films on silicon" in the journal *Science*. The research, funded by ASCENT and led by Professor Sayeef Salahuddin, was featured on the homepage of the journal's website.

JUMP ADA Center at the University of Michigan Hosts Annual Review

After two long years, we are easing our way back into “face to face” events. The JUMP ADA Center at the University of Michigan recently hosted its year 5 Annual Review. This was the first hybrid event since the spring of 2020. Our sponsors, faculty, and scholars were excited to meet in person and many felt that the energy and greater ability to share complex ideas and updates were particularly beneficial.

There were over 100 people in attendance and the ADA Center did an outstanding job of supporting and executing both online and safe in-person attendance. Live streaming and online Q&A helped to engage our international sponsors. For online replay access to the review material, JUMP sponsors can go to https://www.src.org/calendar/e007547/.

Scholar Spotlight

JUMP URI Scholars Georgia Tech Team won 2nd place paper at the ORS Symposium/IEEE RFID Conference. SRC Scholars included Zhuoqi Cai and Brandon Young. Another JUMP URI Scholars team was awarded the People's Choice Award and received a fully-funded trip to present at the IEEE RFID Conference in Las Vegas in late May. SRC Scholars included Inraja Chatterjee and John Grilo.

JUMP Scholar Yandong Luo won the Best Student Paper Award at the IEEE International Memory Workshop for his paper "Performance Benchmarking of Spin-Orbit Torque Magnetic RAM (SOT-MRAM) for Deep Neural Network (DNN) Accelerators,"

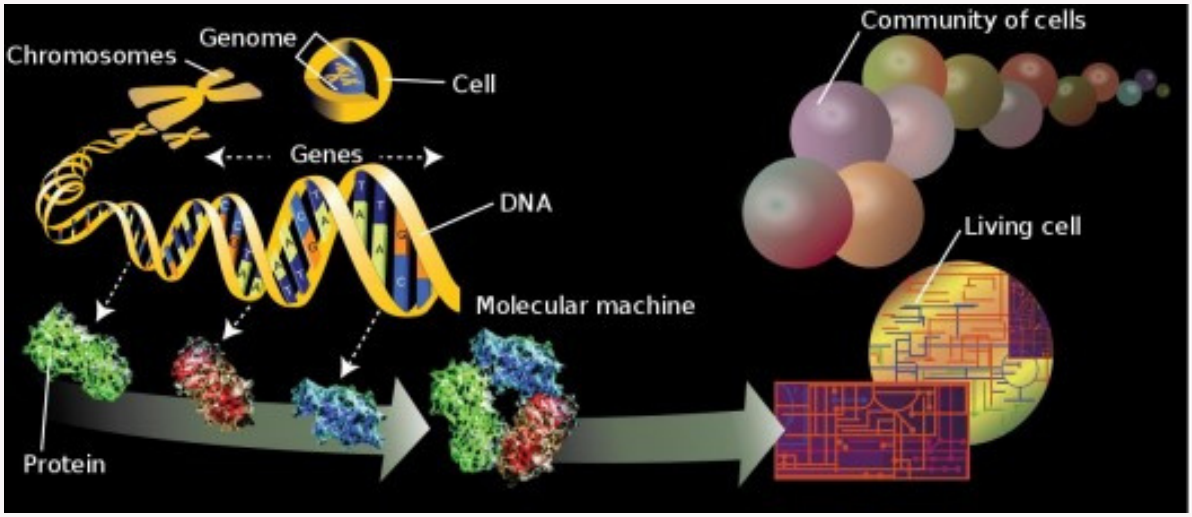
Tech Transfer Series

New frontiers in Precision Medicine: PIM-based Bioinformatics Workflow Using Hyperdimensional Computing

Researchers at the JUMP CRISP Center continue to race ahead in the Precision Medicine project (SRC #2780.023). The team is building a Processing-in-Memory-based system infrastructure for Bioinformatics workflows – computational tools for capturing and analyzing biological data. These workflows encompass enormous multivariate datasets and a wide range of algorithms for Genomics, drug/protein interactions, etc., and cannot be delivered with state-of-the-art systems.

As part of this effort, a team led by PI Tajana Rosing (UC San Diego) is using hyperdimensional computing techniques to develop PIM-based ASICS and FPGAs. These include the GenieHD ASIC, built on JUMP member TSMC's 45nm process. GenieHD speeds up DNA sequencing by over 200x vs CPU. For Microbiome DNA classification, the HD DNA PIM design is 113x faster and 812x more energy efficient than a GPU, and at least 167,000x faster than all state-of-the-art algorithms on CPU.

Member collaboration on the HDC work in CRISP has yielded member transfers to Intel, IBM, Micron, TSMC, Northrop Grumman, SK Hynix, Samsung, and DARPA (HyDDENN). A patent (SRC filing ID P1920) filed in 2021 for genomic sequencing methods using HDC techniques was jointly authored by CRISP researchers and IBM. Not coincidentally, CRISP student Saransh Gupta was hired by IBM Research in 2021!



Top 5 SRC Publications Viewed Across All Programs

- Advances in Digital vs. Analog AI Accelerators - SRC Pub ID P106644
- Hi-K and Ferroelectric AlScN and its use in AlScN/GaN High Electron Mobility Transistors - SRC Pub ID P106748
- Report on the Performance of the 3-bit/Cell FE-SL Memory/Weight Cell - SRC Pub ID P106499
- How Do We Quantify the Application-Level Benefits of a New Technology? A Fundamental Question For Ascent - SRC Pub ID P106273
- Plasma-assisted Degradation of Short-chain Poly- and Perfluoroalkyl Substances (PFAS): Perfluorobutane Sulfonate (PFBS) - SRC Pub ID P106496