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**Semiconductors and Microelectronics Technology**

# Spatiotemporal Computing Utilizing Dual Thermal Dynamics of Mott Memristors


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Date: Thursday, April 10, 2025
Time: 1:30 – 3:00pm PST
Location: EEB 248


**Abstract:** The Mott memristor is a highly intriguing device that demonstrates unique electrical characteristics through the dynamic interaction of heat and current. The device exhibits dynamic thermal behavior, encompassing temporal accumulation via heat capacity and spatial transportation through heat diffusion. This spatiotemporal thermal activity enables coupling between memristor devices when arranged in arrays, which can be effectively utilized for computing. Additionally, the thermal dynamics of Mott memristors inherently involve stochasticity, resulting in probabilistic behavior. These properties, such as thermal coupling and stochasticity, provide a novel approach to tackling NP-hard problems, which are often challenging for conventional computers to solve. This presentation explores various computing devices that leverage the spatiotemporal thermal information of Mott memristors, including true random number generators (TRNGs), probabilistic computing systems, and thermal computing devices. The future potential and implications of these technologies will also be discussed.


**Biography:** Professor Kyung Min Kim is a Tenured Associate Professor in the Department of Materials Science and Engineering at the Korea Advanced Institute of Science and Technology (KAIST) since 2017. He earned his B.S. degree in 2003 and his Ph.D. degree in 2008 from Seoul National University, Seoul, Korea. From 2011 to 2013, he worked at Samsung Electronics in Korea, and from 2014 to 2017, he worked at Hewlett Packard Labs of Hewlett Packard Enterprise in Palo Alto, California, USA. His research covers a wide range of areas related to next-generation semiconductor technology. This includes exploring new semiconductor materials and processing techniques, post-von Neumann computing technologies such as neuromorphic computing, reservoir computing, and probabilistic computing, as well as semiconductor packaging technology.

Hosted by Prof. Jayakanth Ravichandran, Prof. J. Joshua Yang, Prof. Chongwu Zhou, Prof. Stephen Cronin, and Prof. Wei Wu.
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