

# CMOS+X: Physics and Functional Materials for Energy Efficient Electronics



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### Abstract

Despite ominous foretelling of a slowdown, the computational throughput has increased by orders of magnitude over the last decade. Energy efficiency is critical not only to maintain this incessant advancement, but also to ensure that electronics does not become a drag on the finite energy resources of the world. This will need a radical rethinking of the basic building blocks that constitute the electronic hardware. In this talk, I shall briefly present how exploiting physics and functional materials to augment CMOS may offer a new pathway in this context. In particular, I shall discuss logic, memory, and backend technologies where we have achieved record performance by combining new capabilities with CMOS. These examples underscore how functional augmentation of CMOS by harnessing new materials, we are calling it CMOS+X, could offer opportunities that are otherwise not available through conventional means.

### Bio

S. Salahuddin is the TSMC Distinguished Professor of Electrical Engineering and Computer Sciences at the University of California Berkeley. His group explores physics for low power electronic and spintronic devices. He is mostly known for the discovery of the Negative Capacitance effect that shows substantial promise for logic, memory and energy storage devices. Salahuddin received the Presidential Early Career Award for Scientist and Engineers (PECASE) from President Obama. Salahuddin also received several other awards including the National Science Foundation CAREER award, the IEEE Nanotechnology Early Career Award, the Young Investigator Awards from the Airforce Office of Scientific Research and the Army Research Office, and the IEEE George E Smith Award. Salahuddin is a co-director of the Berkeley Device Modeling Center (BDMC) and Berkeley Center for Negative Capacitance Transistors (BCNCT). Salahuddin was also a co-director of ASCENT, which is a flagship device technology effort in the US, jointly supported by SRC and DARPA. He served as the chair the IEEE Electron Devices Society committee on Nanotechnology (2014-16) and is currently the Editor-in-Chief of the IEEE Electron Devices Letters, the premier journal for electron devices. Salahuddin is a Fellow of the IEEE and the APS.

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