PURDUE UNIVERSITY | Electrical and Computer Engineering

Lundstrom-Datta Lecture

Thermoelectric Energy Conversion:
Science and Engineering Challenges and Opportunities

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10:00 am • Purdue Graduate Student Center (PGSC)

Followed by a fireside chat with Ali Shakouri

Abstract: The last 20 years have witnessed intense research focus on the science and engineering of solid-state thermoelectric materials, with the goal of achieving high ZT (~ 2-3) over a large temperature range and thus enabling commercial technology for waste heat recovery and cooling. While the scientific research has to led many fundamental insights about how to engineer the behavior of electrons and phonons, the promise of high ZT and widely-used commercial technology remains largely unfulfilled. For waste heat recovery, this is partly because the performance targets have been raised due to competition from increasingly lower cost of solar and wind electricity. However, with the phasing out of today's refrigerants due to the Kigali amendment of the Montreal Protocol, cooling offers an enormous opportunity if high ZT materials can be developed for room temperature operation, and system-level costs can be reduced and performance increased. The increase of ZT at room temperature requires new mechanisms and science to engineer the electronic and phononic structure and transport. This talk will provide a viewpoint of these new scientific opportunities and challenges in the context of practical performance and cost metrics. It will also offer new approaches to manipulate entropy change in liquid media for the purpose of energy conversion. .

Bio: Dr. Arun Majumdar is the Jay Precourt Provostial Chair Professor at Stanford, and a faculty member in Mechanical Engineering and Materials Science and Engineering. He is co-director of the Precourt Institute for Energy, which integrates and coordinates research and education activities across all seven Schools and the Hoover Institution. Dr. Majumdar's current research focuses on electrochemical and thermochemical redox reactions that are fundamental to a sustainable energy future, multidimensional nanoscale imaging and microscopy, and a new effort to re-engineer the electricity grid using data science, including deep learning techniques. He was the founding director of ARPA-E before which he was the Almy & Agnes Maynard Chair Professor of Mechanical Engineering and Materials Science & Engineering at UC–Berkeley. Dr. Majumdar is a member of the National Academy of Engineering and the American Academy of Arts and Sciences.

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