INSTITUTE COLLOQUIUM

02nd June, 2023, 4.00 pm at FERMION Hall

* TITLE:: Energy-efficient information processing in our information hungry world

ABSTRACT:: One of the most valuable resources for humankind is "information." The amount of information that is sensed, produced, processed, stored, or communicated in our society every year is truly astronomical. Whether it is uploading one's vacation photos on Meta, reaching out to a loved one in WhatsApp, forecasting tomorrow's weather, decoding the human genome, or inciting a rebellion in Twitter - an enormous amount of information is processed annually, and the number of digital bits that are used up to encode that information would easily exceed the number of atoms in the visible universe. Information, it turns out, is "physical," and therefore, there is always some energy cost associated with information. The energy dissipated to perform 300 Google searches on a PC is currently more than enough to boil 1 liter of water at room temperature. Today, roughly 10% of the energy produced in the United States is consumed by its information processing infrastructure and it is expected to grow to 25% by the year 2030, while the carbon footprint of a typical data center in the US now exceeds that of a nation like Malaysia. Even humans as computers are energy-hungry, and roughly 20% of the calories consumed by us is used by the brain to "think." It, therefore, behooves us to seek increasingly energy efficient devices and hardware for information processing, while remaining conscious about societal needs such as privacy, fairness, and egalitarianism. This talk will describe fundamental energy limits to processing one digital bit of information (no civilization, terrestrial or extra-terrestrial can exceed it), energy needs for increasingly sophisticated communication infrastructures (5G/6G/7G networks), and the global research in non-traditional information processing devices and unconventional architectures that are expected to be maximally energy-efficient so that they can meet the information processing needs for the next two decades.

SPEAKER: Prof. Supriyo Bandyopadhyay

Supriyo Bandyopadhyay is Commonwealth Professor of Electrical and Computer Engineering at Virginia Commonwealth University (VCU) where he directs the Quantum Device Laboratory. Research in the laboratory has been frequently featured in national and international media (newspapers, internet blogs by media persons, magazines, journal highlights such as in Nature and Nanotechnology, CBS, NPR, and internet news portals).

In 2016, he was named Virginia's Outstanding Scientist by the Governor and in 2018, he received the State Council of Higher Education for Virginia Outstanding Faculty Award which is the highest teaching award accorded to any faculty member in any college or university in Virginia. In 2012, he received the Distinguished Scholarship Award from VCU and in 2017 he received the University Award of Excellence – both given to one faculty member in the university in any year. His department gave him the Lifetime Achievement Award in 2015. In 2020, Prof. Bandyopadhyay was named the winner of the "Pioneer in Nanotechnology" award by the Institute of Electrical and Electronics Engineers (IEEE), the world's largest professional organization. This is the highest honor given by IEEE in nanotechnology. In 2020-2021, he served as a Jefferson Science Fellow of the US National Academies of Science, Engineering and Medicine and acted as Senior Advisor to the USAID Bureau for Eastern Europe and Eurasia, Division of Energy and Infrastructure. Prof. Bandyopadhyay is a Fellow of IEEE, American Physical Society, Institute of Physics (UK), the Electrochemical Society, and the American Association for the Advancement of Science.

Webinar link

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