

MSE-Colloquium@NTU

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Lecture Theatre 3 ([NS4-02-32](#))



Beyond Charge Currents: Spin and Ion Currents for Future Data Storage and Computing Technologies

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Abstract

The era of computing technologies based on charge currents is coming to an end after more than forty years of exponential increases in computing power and data storage that have been largely based on shrinking devices in two dimensions. A new era of “Beyond charge!” will evolve over the next decade that will likely be based on several new concepts. Firstly, devices whose innate properties are derived not from the electron’s charge but from spin currents as well as from ion currents. In some cases, new functionality will arise that can extend charge-based devices but in other case fundamentally new computing and data storage paradigms will evolve. Secondly, devices will inevitably become three-dimensional: novel means of constructing devices, both from bottom-up and top-down, will become increasingly important. Thirdly, bio-inspired devices that may mimic the extremely energy efficient computation systems in the biological world are compelling. In this talk I will focus on spintronics, namely, spin current based phenomena and devices and discuss the past, present, and future of spintronic technologies.

Biography

Stuart Parkin is Director of the Max Planck Institute for Microstructure Physics, Halle, Germany, and an Alexander von Humboldt Professor, Martin Luther University, Halle-Wittenberg. His research interests include spintronic materials and devices for advanced sensor, memory, and logic applications, oxide thin-film heterostructures, topological metals, exotic superconductors, and cognitive devices. Parkin’s discoveries in spintronics enabled a more than 10,000-fold increase in the storage capacity of magnetic disk drives. For his work that thereby enabled the “big data” world of today, Parkin was awarded the Millennium Technology Award from the Technology Academy Finland in 2014 and, most recently the King Faisal Prize for Science 2021 for his research into three distinct classes of spintronic memories. Parkin is an elected Fellow/ Member: Royal Society (London), Royal Academy of Engineering, National Academy of Sciences, National Academy of Engineering, German National Academy of Science - Leopoldina, Royal Society of Edinburgh, Indian Academy of Sciences, and TWAS - academy of sciences for the developing world. Parkin has received numerous awards including the American Physical Society International Prize for New Materials (1994); Europhysics Prize for Outstanding Achievement in Solid State Physics (1997); 2009 IUPAP Magnetism Prize and Neel Medal; 2012 von Hippel Award - Materials Research Society; 2013 Swan Medal - Institute of Physics (London); Alexander von Humboldt Professorship – International Award for Research (2014); Millennium Technology Award (2014); ERC Advanced Grant - SORBET (2015); King Faisal Prize for Science 2021; ERC Advanced Grant – SUPERMINT (2022). Parkin has received 4 honorary doctorates. Parkin has published >660 papers, has >122 issued patents, and has given >800 invited talks around the world. Parkin was named a “Highly Cited Researcher” by Clarivate for the years 2018-2022 and has an h-index of 127.