

## Physical, information & Engineering Sciences category

**Dr Anjan Soumyanarayanan**

Scientist

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***“For his research unveiling and tailoring emergent quantum phenomena towards scalable nanoelectronics”***

Electronic miniaturization and growing computing demands have fuelled the quest for fundamentally new technology platforms – fast, stable, and energy-efficient at the nanoscale. Anjan’s research seeks to realize such scalable nanoelectronic devices by harnessing novel quantum phenomena emerging at material surfaces and interfaces. His contributions to unveiling emergent properties of electronic materials have enabled tailoring of two-dimensional (2D) quantum phases and spin topology towards advanced nanoelectronics.

Anjan’s early work on developing picometre-resolved spectroscopic imaging led to discoveries of a strain-induced quantum phase transition in the 2D material NbSe<sub>2</sub> and doping-induced charge-order and associated quantum phase transition in 2D copper oxides. The first of these, with concomitant developments, gave birth to strain engineering of quantum materials. He further employed spectroscopic quasiparticle imaging to study spin-polarized 2D states in topological materials, which enabled the recent discovery of heavy Dirac fermions – promising candidates for topological quantum computation.

In recent years, Anjan formed an A\*STAR-led interdisciplinary team to study magnetic skyrmions. These nanoscale 2D spin structures with ambient topological stability have imminent utility towards low-power computing. His team leveraged on A\*STAR’s capabilities to develop a thin film material that uniquely enables bottom-up control of skyrmion properties. By modulating the parent spin-orbit interaction, they could smoothly tailor the skyrmion size, stability, and density using techniques compatible with industry (CMOS) fabrication. They have since used this skyrmion platform to demonstrate electrical detection and device-level manipulation towards GHz information processing and synaptic computing. Anjan’s team looks to build on their spin-orbit technology (SpOT) capabilities and catalyse advanced electronics in Singapore.

Anjan’s research has led to numerous publications in prestigious journals such as Nature, Science, Proceedings of the National Academy of Sciences, and Physical Review. Anjan was the sole worldwide recipient of the 2018 IEEE Magnetics Early Career Award for his experimental materials discovery work on skyrmions at A\*STAR. He was among the inaugural recipients of the A\*STAR National Science Scholarship.