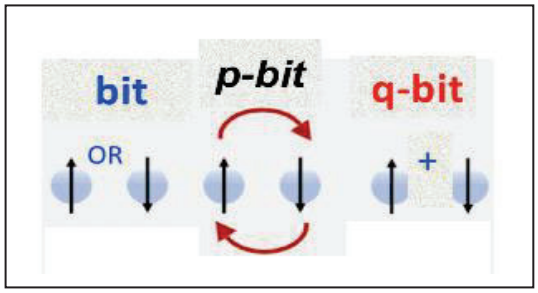
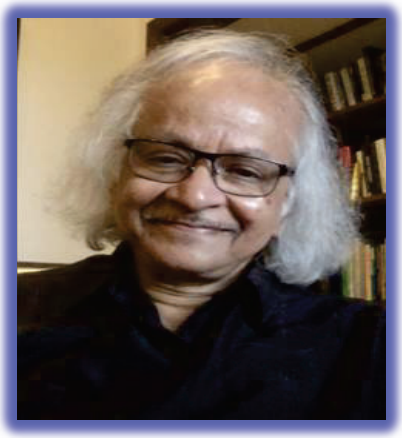
Probabilistic Computing with p-Bits: Between a Bit and a *q*-Bit

Digital computing is based on a deterministic bit with two values, 0 and 1. On the other hand, quantum computing is based on a q-bit which is a delicate superposition of 0 and 1. This talk draws attention to something in-between namely, a ***p*-bit** which is a robust classical entity fluctuating between 0 and 1.

We have demonstrated experimentally that these ***p*-bits** can be built with existing technology to operate at room temperature and used as building blocks for constructing autonomous ***p*-circuits** [1]. We argue that such p-circuits can function as hardware accelerators for many applications that use stochastic algorithms. At the same time they highlight the key role of quantum interference in enabling the awesome potential of quantum computing.



[1]W.A. Borders et al. "Integer Factorization using Stochastic Magnetic Tunnel Junctions," Nature **573**, 390 (2019).



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Dr. Supriyo Datta is known for pioneering an approach to quantum transport, combining the NEGF method of many-body physics with the Landauer approach from mesoscopic physics. This approach has been widely adopted in the field of nanoelectronics for which he was elected to the National Academy of Engineering. Datta is also credited for innovative theoretical proposals that have inspired new fields of research including molecular thermoelectricity, negative capacitance devices, and spintronics.