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Tutorial 1:

Title: Straintronics: Replacing transistors (charge) with strain-switched nanomagnets (spin) for ultra-energy-efficient computing and information processing

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Abstract:

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The workhorse of electronics for the last five decades has been the celebrated transistor which experienced relentless downscaling in accordance with Moore's law. Unfortunately, the decreased size has also increased the energy dissipation per unit area on electronic chips, portending the demise of Moore's law. A number of ideas have recently been put forth, articulating, primarily, replacement of "charge" as the state variable for encoding information (as in transistors) with "spin" of electrons, with the hope that this will reduce the energy cost of information processing. Attention has been focused on bistable nanomagnets as potential binary switches because they offer both low dissipation and non-volatility. How energy-efficient nanomagnets can be, however, depends on how they are switched and one of the most energy-frugal method is to switch them with electrically generated mechanical strain. This field -termed "straintronics" - has burgeoned into a major research area. The tutorial will explore various facets of straintronics, its pros and cons, and focus on new opportunities afforded by this intriguing technology.

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