OAK RIDGE NATIONAL LABORATORY
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Multimodal Responses of Self-Organized Circuitry in Electronically Phase Separated Materials

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Technology Summary

As the end to Moore's Law approaches and technology moves toward mobile device architectures, the semiconductor industry is starting the necessary reworking of their decades' old methodology to improving device performance by reducing transistor sizes in Si devices. The new approach aims to increase performance by developing hardware around intended applications. This means that the materials and architectures driving supercomputers, desktops, and smart phones will no longer follow the one-chip-fits-all approach. Instead, flexible chip architectures, multifunctionality, and low power consumption will be the driving forces for figure of merit in performance advances. These radically different demands from previous semiconductor technologies mean that we must broaden our scope not only to consider new types of computing, such as quantum and neuromorphic, but to explore new materials and architectures, which do not rely on traditional switching responses. We have invented a platform from which to design multimodal functionality and allow access to low power electroresistive switching, low field magnetoresistive switching, and self-organized RC circuit-like behaviors. These properties offer the promise of designing new device architectures based on multi-stimulus responses at reduced power consumption levels.

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