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**From nano to micro: hierarchical ordering at the nanoscale**[1]

EZEKIEL JOHNSTON-HALPERIN, Department of Physics, Ohio State University

The overall goal of controlling structural and electronic materials properties at nanometer length scales can be thought of as the intersection of two distinct but correlated challenges. The first is the synthesis/fabrication of individual nanoscale structures and the second is the arrangement of those structures into tailored nano- and micro-scale assemblies. Motivated by these twin challenges, the development of the superlattice nanowire pattern transfer (SNAP) technique has enabled the fabrication of highly ordered arrays of hundreds of nanowires (both metallic and semiconducting) at pitches down to 16 nm and aspect ratios up to $10^6$. As a result of the hierarchical ordering of these assemblies (ranging from nanometer to micrometer length scales), it is possible to achieve electronic point-addressability within the arrays using traditional lithography. Further, iterative use of this technique to generate orthogonal nanowire arrays yields extremely dense crossbar circuits; with a bit density of $\sim 0.5$ TBit/in$^2$ ($10^{11}$ Bits/cm$^2$) these structures approach crystallographic density. Both realized and potential applications of these structures ranging from ultra-dense electronic circuits to optical and electronic meta-materials will be discussed.

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