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(I) Exploring Unconventional Resistivity Scaling in Topological Semimetals for Interconnects Beyond Copper

Tuesday 20 June 2023 11:45 (30 minutes)

The scaling of interconnect wiring in integrated circuits leads to increasing resistivity of Cu wires and degrades the chip power-performance significantly. Current research on alternative interconnect conductors is largely limited to conventional metals for mitigating the growing line resistance. Here we explore topological conductors as a potential solution. Using CoSi and NbAs as examples, we find that, through the dominant surface-state conduction, the resistivity in topological semimetals reduces with decreasing feature sizes in the nanometer scale. This trend holds even in the presence of mild disorder and grain boundaries, in sharp contrast to conventional metals. We will present detailed first-principles calculations and report experimental evidence for unconventional resistivity scaling in CoSi thin films, showing resistivity significantly below that of ideal bulk single crystals. We will conclude with a set of guidelines to screen topological semimetals for beyond-Cu interconnects and a list of key next steps.

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