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Title: "Quantum device opportunities in ultrathin silicon-on-insulator"

Abstract:

Silicon-on-insulator (SOI) transistors built in thin fully-depleted Si channels on top of an insulating buried oxide are predicted to take over from bulk Si CMOS devices because of their superior scaling properties. The continuing miniaturization of SOI devices, with available Si channel and gate insulator thickness dropping to the nanoscale, as well as integration of ultrathin SOI with novel dielectrics and gate materials, is opening the door to Si-compatible quantum effect devices. This is important because a great many quantum effect devices demonstrated in bandgap-engineered III-V hetero-structures have not been used in mainstream technology, which is dominated by Si.

Here we will present some proof-of-concept structures that appear suitable for exploitation in the SOI world: lateral interband tunneling transistor (LITT), vertical tunneling transistor (VTT), VTT-based intersubband laser, and real-space transfer transistors. All of these devices have been envisaged in III-V heterostructures, but SOI implementations offer both compatibility and functional advantages. To become useful, these devices need fabrication advances beyond the current state of the art. Still, the point is that novel devices and functionalities can still be grafted onto the rapidly growing SOI technology -- an opportunity that device physicists should not miss.

Alex Zaslavsky received his Ph.D. in electrical engineering from Princeton University in 1991. From 1991 to 1993 he was a postdoctoral scientist at IBM Research, Yorktown Heights. In 1994 he became an Assistant Professor of Engineering at Brown University, where he is now Associate Professor of Engineering and Physics. He is a recipient of a Sloan Fellowship, an Office of Naval Research Young Investigator award, and a National Science Foundation Career award. In 2000-1 he spent a sabbatical year at LETI-CEA, Grenoble, France, and has also worked at CNRS laboratories in Marseille and Grenoble. He has authored over 60 journal articles and book chapters, and co-edited five books in the microelectronics field. In 2003 he became an editor of *Solid State Electronics*. Research interests include resonant tunneling and strain spectroscopy in nanostructures, tunneling-based semiconductor devices, ultrathin semiconductor-on-insulator structures, carbon nanotube transport, and nanofabrication by epitaxial regrowth.

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