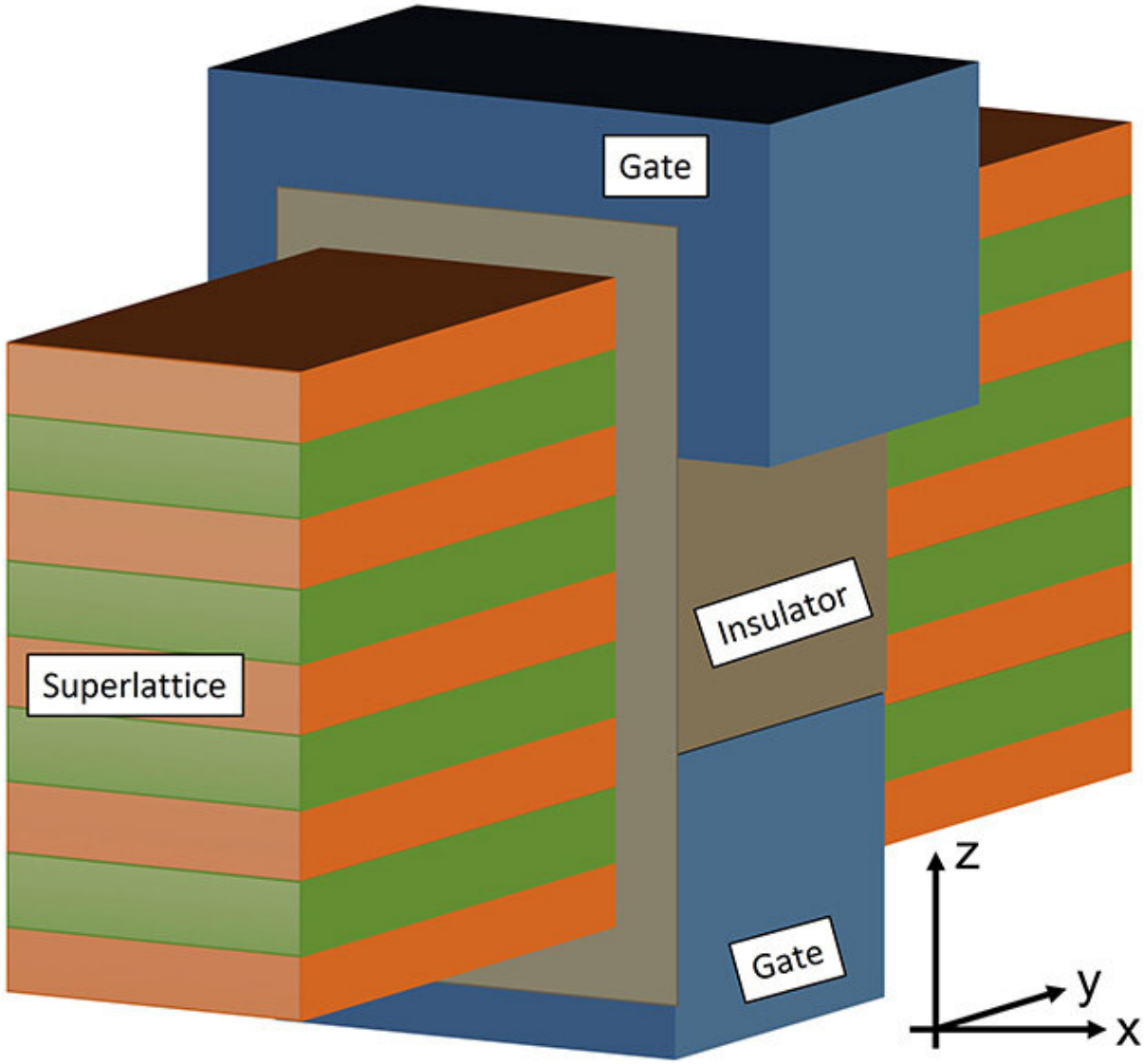
Technology for downscaling transistors could advance semiconductor design

September 20 2021, by Steve Martin



Purdue University engineer Tillmann Kubis has created CasFET, or cascade

field effect transistor, technology. The key aspect is the superlattice perpendicular to the transistor's transport direction, which allows for switchable cascade states. Credit: Tillmann Kubis

An innovation by Purdue University researchers could help the semiconductor industry design transistors that are smaller, use less power and switch from on to off at smaller applied voltages. As a result, the innovation could lead to better and more powerful central processing unit generations, which can compute more operations with less energy.

Tillmann Kubis is the Katherine Ngai Pesic & Silvaco Research Assistant Professor of Electrical and Computer Engineering in Purdue's Elmore Family School of Electrical and Computer Engineering. He said it has become more difficult to meet the performance requirements of nanotransistors.

"They need a high enough ON-current and low enough OFF-current, with a small enough difference to switch between both," Kubis said. "These challenges have significantly slowed the downscaling of transistors around the last eight years, making it increasingly difficult to introduce more powerful CPU generations."

Kubis and James Charles, a senior research associate in the Elmore Family School of Electrical and Computer Engineering, have created CasFET, or cascade field effect transistor, technology. It introduces a new switching method to transistors, one that is like the effects observed in quantum cascade lasers.

"CasFET is a more general approach than transistor technology we had developed several years ago. It offers more flexibility in the choice of materials and voltage settings," Kubis said. "In technical terms, CasFET

does not require band-to-band tunneling. Because of this, semiconductor designers could be able to develop faster-switching and more energy-efficient transistors."

Kubis and Charles continue to develop the first CasFET prototype.

"Once that is showing the performance goals, we will continue with defining a concrete CasFET prototype design," Kubis said.

Provided by Purdue University

Citation: Technology for downscaling transistors could advance semiconductor design (2021, September 20) retrieved 17 April 2024 from https://techxplore.com/news/2021-09-technology-downscaling-transistors-advance-semiconductor.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.