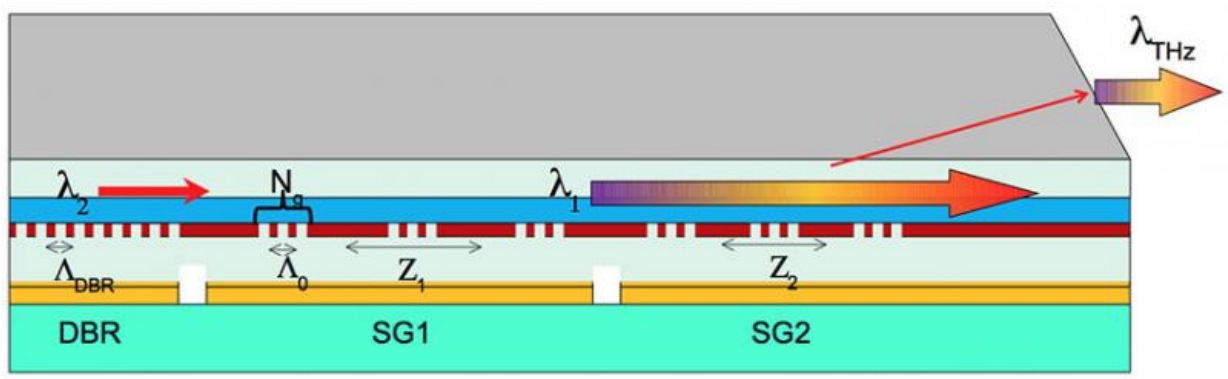
New terahertz source could strengthen sensing applications

March 28 2016



The design of Razeghi's terahertz tuning source.

Current terahertz sources are large, multi-component systems that sometimes require complex vacuum systems, external pump lasers, and even cryogenic cooling. The unwieldy devices are heavy, expensive, and hard to transport, operate, and maintain.

Now Northwestern University's Manijeh Razeghi has developed a new type of security detection device that bypasses these issues. With the ability to detect explosives, chemical agents, and dangerous biological substances from safe distances, the device could make public spaces more secure than ever.

"A single-component solution capable of room temperature continuous

wave and widely frequency tunable operation is highly desirable to enable next generation terahertz systems," said Razeghi, Walter P. Murphy Professor of Electrical Engineering and Computer Science in Northwestern's McCormick School of Engineering.

Director of Northwestern's Center for Quantum Devices, Razeghi and her team have demonstrated a room temperature continuous wave, highly tunable, high-power terahertz source. Based on nonlinear mixing in quantum cascade lasers, the source can emit up to multi-milliwatts of power and has a wide frequency coverage of one-to-five terahertz in pulsed mode operation.

Funded by the National Science Foundation, Department of Homeland Security, Naval Air Systems Command, and NASA, the research was published on March 25 in Nature *Scientific Reports*. This new research builds on Razeghi group's many years of research with Northwestern's Center for Quantum Devices, including the development of the first single mode room temperature terahertz laser in 2011.

"I am very excited about these results," Razeghi said. "No one would believe any of this was possible, even a couple years ago. This initial demonstration was very exciting, and continuing developing will lead us to the new frontier of terahertz technology."

More information: Quanyong Lu et al. Room temperature continuous wave, monolithic tunable THz sources based on highly efficient mid-infrared quantum cascade lasers, *Scientific Reports* (2016). DOI: 10.1038/srep23595

Provided by Northwestern University