Laser pulses light the way to tuning topological materials for spintronics and quantum computing

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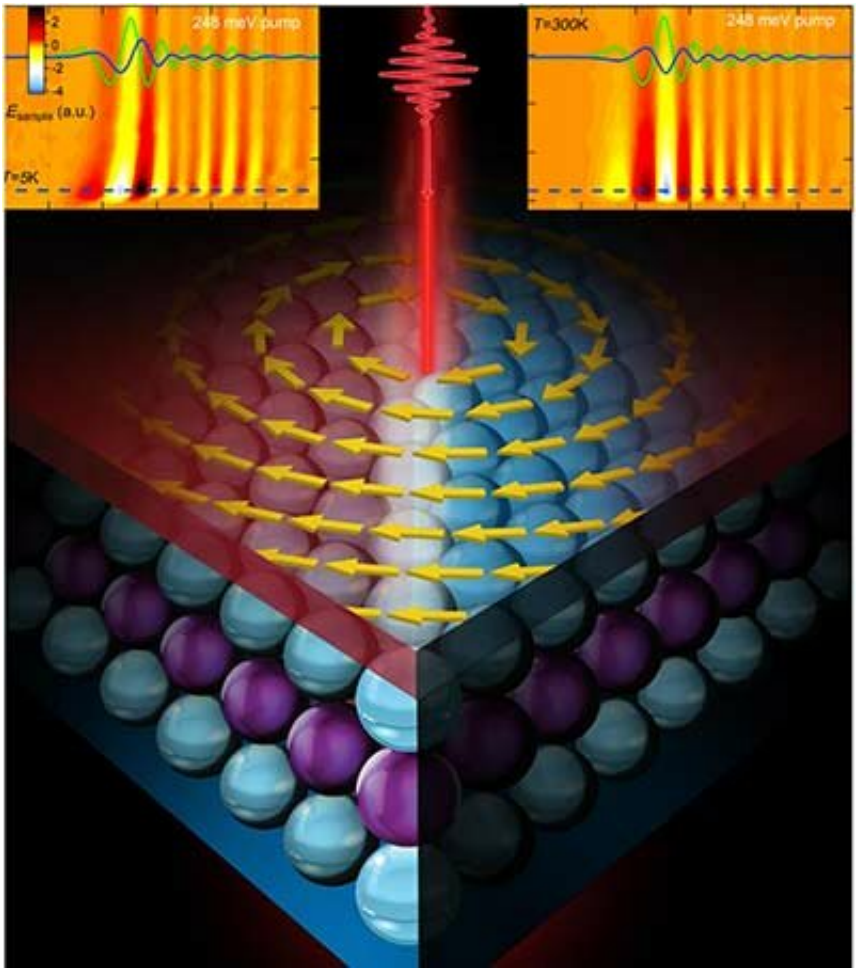

By employing ultra-short mid-infrared and terahertz pulses of less than one trillionth of a second, researchers at Ames Laboratory were able to successfully isolate and control the surface properties of a bismuth-selenium (Bi_2Se_3) 3-D topological insulator. Credit: Ames Laboratory

Scientists at the U.S. Department of Energy's Ames Laboratory have discovered a means of controlling the surface conductivity of a three-dimensional (3-D) topological insulator, a type of material that has potential applications in spintronic devices and quantum computing.

Three-dimensional topological insulators are emerging materials that hold great promise due to their unique electron conducting states on their surfaces, immune to backscattering, versus the bulk interior, which behaves as a normal insulator.

But a challenge remains in underpinning and selectively controlling their high frequency transport at the surface without an increased scattering from the bulk material.

By employing ultra-short mid-infrared and terahertz pulses of less than one trillionth of a second, researchers at Ames Laboratory were able to successfully isolate and control the surface properties of a bismuth-selenium (Bi_2Se_3) 3-D topological insulator.

The method provides what is essentially a new "tuning knob" for controlling the protected surface conductivity in this category of materials.

"We believe that this study could evolve into a benchmark method of characterizing and manipulating these materials, so they can be better understood and adapted for applications in new quantum technologies," said Jigang Wang, Ames Laboratory physicist and Iowa State University professor.

The research is further discussed in a paper, "Ultrafast manipulation of topologically enhanced surface transport driven by mid-infrared and

terahertz pulses in Bi_2Se_3" in *Nature Communications*.

More information: L. Luo et al. Ultrafast manipulation of topologically enhanced surface transport driven by mid-infrared and terahertz pulses in Bi_2Se_3, *Nature Communications* (2019). DOI: 10.1038/s41467-019-08559-6

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