

T-QUAKE Quantum Mechanical Microchip

4b) Describe how your product/service improves upon competitive products or technologies.

The Sandia team has created the first-ever functioning CV-QKD quantum photonic transceiver on a chip. Miniaturizing and integrating a tabletop full of advanced bulk optical quantum photonics technologies onto a microchip yields more than 20 improvements in device functionality, system performance, and security. At the same time, thousands of devices can be printed using traditional CMOS technology rather than being individually hand-manufactured and assembled. Instead of sitting in rack-mounted air-cooled boxes, T-QUAKE devices can be incorporated directly into existing consumer electronics such as laptops and cell phones. Because the devices are compatible with existing CMOS fabrication technologies, complex control circuits can be seamlessly integrated with photonics technologies to automate and process data from thousands of classical and quantum elements. Monolithic microfabrication allows for mechanical stability over the entire complex circuitry – a differentiating advantage over highly sensitive bench-top-scale optical equipment that requires frequent calibration. From a security standpoint, integrating optical elements into a microchip makes it considerably more difficult for a potential adversary to access, analyze, or modify the system. Altogether, this first-ever chip-scale quantum communications circuit dramatically improves performance, form factor, and ease of use while driving down size, weight, power, and cost by orders of magnitude. New applications thus become viable, such as consumer digital and physical security, hack-proof microgrid energy distribution, and tamper-proof packaging.