UBC physicists develop 'impossible' technique to study and develop superconductors

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A team of University of British Columbia researchers has developed a technique that controls the number of electrons on the surface of high-temperature superconductors, a procedure considered impossible for the past two decades.

Led by Physics Assoc. Prof. Andrea Damascelli, the team deposited potassium atoms onto the surface of a piece of superconducting copper oxide. The approach allows the scientists to continuously manipulate the number of electrons on ultra-thin layers of material.

The details are published this week in the prestigious journal *Nature Physics*.

Superconductivity – the phenomenon of conducting electricity with no resistance – occurs in some materials at very low temperatures. High-temperature superconductors are a class of materials capable of conducting electricity with little or no resistance in temperatures as high as -140 degrees Celsius.

"The development of future electronics, such as quantum computer chips, hinges on extremely thin layers of material," says Damascelli, Canada Research Chair in the Electronic Structure of Solids.

"Extremely thin layers and surfaces of superconducting materials take on

very different properties from the rest of the material. Electrons have been observed to re-arrange, making it impossible for scientists to study," says Damascelli. "It's become clear in recent years that this phenomenon is both the challenge and key to making great strides in superconductor research.

"The new technique opens the door to systematic studies not just of high-temperature superconductors, but many other materials where surfaces and interfaces control the physical properties," says Damascelli. "The control of surfaces and interfaces plays a vital role in the development of applications such as fuel cells and lossless power lines, and may lead to new materials altogether."

The superconductors Damascelli's team experimented on are the purest samples currently available and were produced at UBC by physicists Doug Bonn, Ruixing Liang and Walter Hardy.

Part of the study was carried out at the Advanced Light Source synchrotron in California. In the future, the design and study of novel complex materials for next-generation technologies will be carried out at the Quantum Materials Spectroscopy Center currently under construction at the Canadian Light Source in Saskatoon under Damascelli's leadership.

Source: University of British Columbia