Physicists find structural phase transitions in 2-D atomic materials

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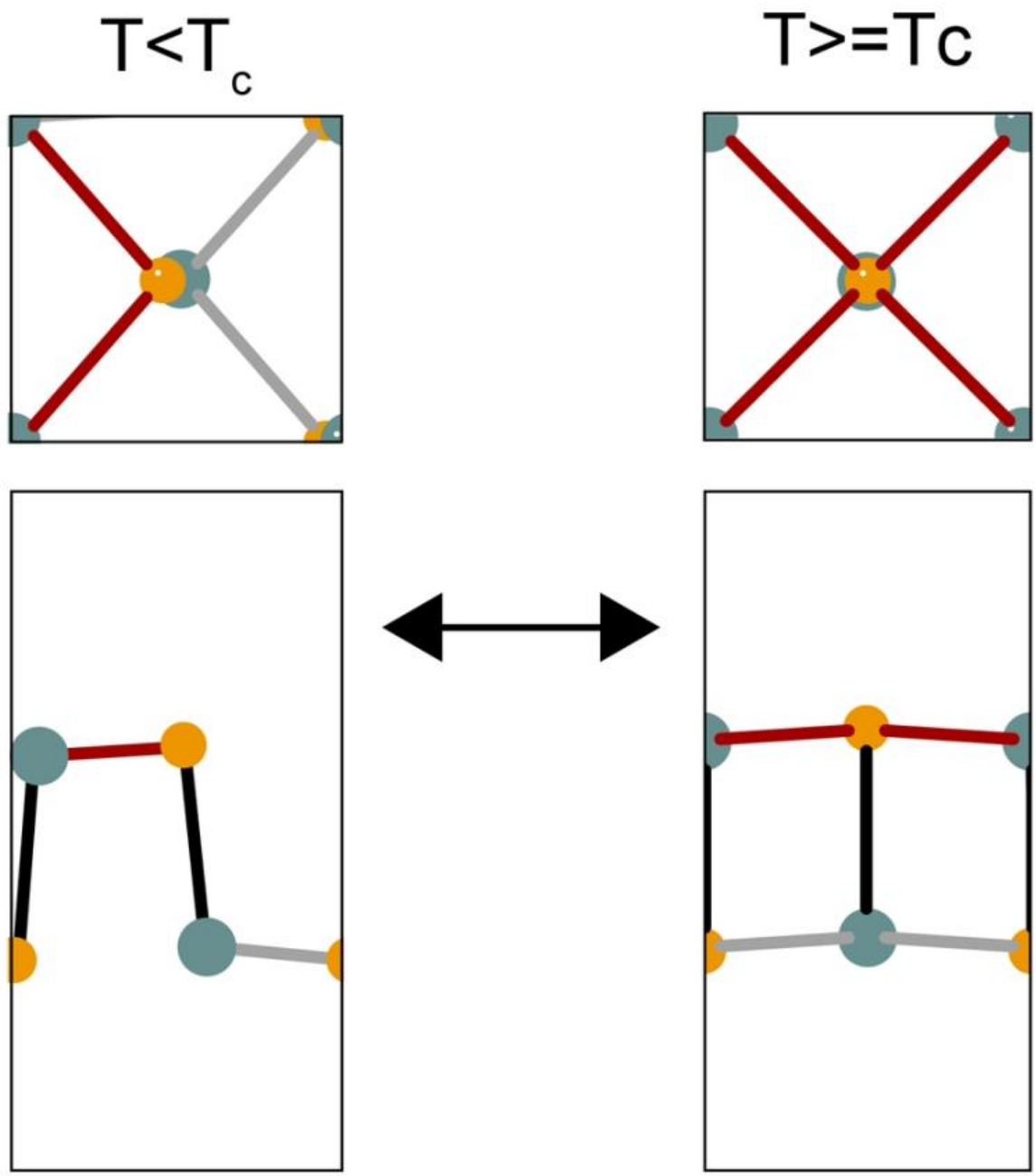

Credit: Salvador Barraza-Lopez

An international team led by University of Arkansas physicists has discovered drastic changes in material properties occurring in a group of

two-dimensional materials that are being investigated as candidates to power the next generation of opto-electronic devices.

The findings, published in the journal *Physical Review Letters*, reveal the rich properties of a new class of "phase-change" 2-D materials known as group-IV monochalcogenide monolayers and bilayers.

The U of A team consisted of Mehrshad Mehboudi, a doctoral student; Yurong Yang, a research assistant professor; Laurent Bellaiche, Distinguished Professor of physics; and assistant professors of physics Pradeep Kumar and Salvador Barraza-Lopez. Their collaborators were Benjamin Fregoso at the University of California-Berkeley, Wenjuan Zhu and Arend van der Zande, both at the University of Illinois; and Jaime Ferrer from Universidad de Oviedo in Spain.

"We are the first team to even realize the possibility of such two-dimensional structural transitions in 2-D atomic materials, and the first team to ever study the effect of such transitions on material properties," Barraza-Lopez said.

The transition is the change from a rectangle to a square unit cell occurring near room temperature. As a result of the transition, optical properties, charge transport, and intrinsic dipole moments in the case of monolayers are shown to change in an abrupt manner.

"These changes in properties make these materials an exciting platform for novel optoelectronic applications, and they also uncover fundamental physics of structural phase transitions in reduced dimensions," Barraza-Lopez said. "No such detailed analysis had been provided before this work."

Provided by University of Arkansas