Collaboration with Elite Institutions: Dr. Hung-Chung Hsueh, Chih-En Hsu, I-An Lin's Paper Published by a Highly Cited International Journal "Nature Communications"

Physics Professor and Dean of Research and Development, Dr. Hung-Chung Hsueh, along with doctoral student Chih-En Hsu, alum I-An Lin, Professor Chih-Wei Luo from the Department of Electrophysics at National Yang Ming Chiao Tung University, Distinguished Professor Chin-Shan Lue from National Cheng Kung University, Deputy Director and Distinguished Research Fellow of the Center for Condensed Matter Sciences at National Taiwan University (NTU), Dr. Ming-Wen Chu, Distinguished Research Fellow Yu-Ming Chang, Group Leader Cheng-Mao Cheng, and Dr. Ping-Hui Lin from Condensed Matter Physics Group at National Synchrotron Radiation Research Center, completed the paper titled "Three-dimensional ultrafast charge-density-wave dynamics in CuTe," which was published in the highly-cited international journal "Nature Communications" on March 16. This journal ranks 6th among 73 renowned SCI journals in various multidisciplinary science fields, including Nature and Science, with a five-year average impact factor of 17.

As one of the corresponding authors, Dr. Hsueh explained, this collaboration brought together the latest experiments by Dr. Luo, measurement techniques from NTU, and the advanced physics computational capabilities of Tamkang University. In the low-dimensional material copper telluride (CuTe), a series of novel physical phenomena—Charge Density Wave (CDW) states—were discovered, along with the dimensional evolution of CDW and its stabilization mechanisms at different temperature ranges. Due to the unique conditions created by low-dimensional materials, the order parameters (including electronic, spin, lattice, etc.) interact and compete. In this study, precise temperature modulation and a combination of various cutting-edge experimental and theoretical techniques were employed, such as axial and time-resolved ultrafast spectroscopy, scanning tunneling microscopy, high-resolution Raman spectroscopy, and first-principles spectroscopic calculations, to verify CDW states of different dimensions and identify new regularities and structures.

CDW materials have various applications, such as electronic components, thermoelectric or optoelectronic energy converters, high-speed, low-power new memory devices, low-temperature superconducting electromagnetic motors or maglev trains, pressure or temperature sensors, etc.

Chih-En Hsu has received the Overseas Project for Post Graduate Research of the National Science and Technology Council and is currently studying at the University of Southern California in the United States. I-An Lin has graduated with a master's degree and is now employed. Dr. Hsueh stated that the students and scholars involved in this academic paper are mainly middle-aged and young. "By participating in the Physical Society of Taiwan, I can collaborate with scholars from national and private universities in this field, contribute our expertise, conduct joint research, expand cooperation, submit manuscripts to high-level international journals, and increase international visibility. I also hope to cultivate outstanding students so that even if they are admitted to top national universities in the future, they can still engage in collaborative research."

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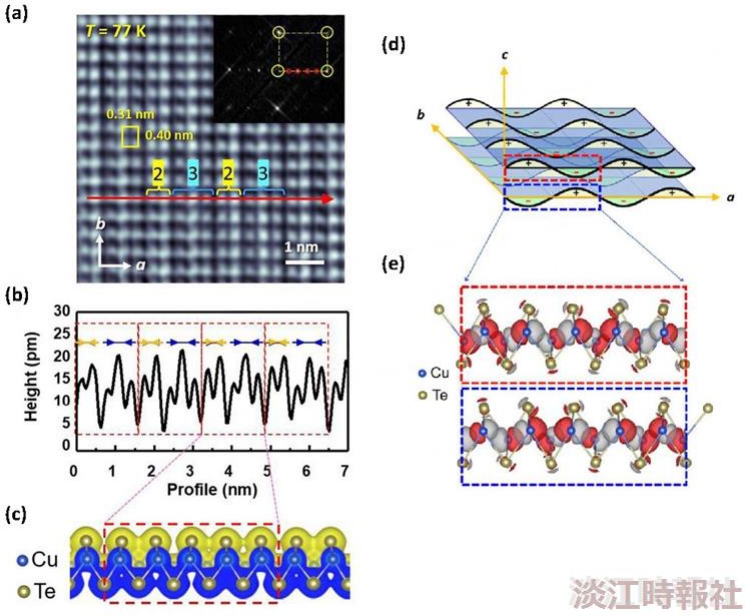
Physics Department Professor and Dean of Research and Development, Dr. Hung-Chung Hsueh (right), and Ph.D. candidate Chih-En Hsu see their paper published by a highly cited international journal, "Nature Communication."



2. (a) CDW modulation in copper telluride (CuTe) along the crystallographic a-axis (red arrow) observed by scanning tunneling microscopy experiments at a low temperature (77K).

(b) Atomic height profile of the CDW state forming superlattice along the crystallographic a-axis (red dashed line).

(c) First-principles calculated charge density distribution in a specific superlattice periodicity, which agrees perfectly with the unit shown in (b).

(d) Schematics of a three-dimensional anti-phase CDW state (red/blue dashed boxes) along the c-axis induced by interlayer coupling of CuTe structures at low temperature.

(e) Modulated structure of the CDW in (d) with charge density difference between CDW and non-CDW states obtained by first-principles calculations (gray (red) area denotes the increasing (decreasing) in corresponding charge density).