

中央大學物理學系

Department of Physics, National Central University



## Colloquium

# Ultrafast science and dynamics in quantum materials

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Date: 2024/06/11 (Tue)

Venue: S4-625

Time: 14:00-16:00

### Abstract :

In this talk, I will first introduce ultrafast science and technology. Then, I am going to show some applications of ultrafast micromachining, the development of novel light sources (e.g., circularly polarized THz waves and ultra-broadband mid-IR), and ultrafast pump-probe spectroscopy. For the ultrafast pump-probe spectroscopy, I will take the CuTe as an example, which is a well-known charge density wave (CDW) material. Using the distinct temperature evolution of orientation-dependent ultrafast electron and phonon dynamics, various dimensional CDW phases are verified in CuTe, and the electronic subsystem in CuTe is also demonstrated to drive the formation of one-dimensional (1D) CDW chain phase at  $T_c$  of 335 K [1]. At  $T=280$  K, electron-phonon coupling creates collective modes along the  $a$ -axis, synchronizing via an interchain interaction to establish a two-dimensional (2D) CDW phase on the  $ab$ -plane while  $T<250$  K. The 2D CDW phase planes are finally locked with each other in anti-phase to form a three-dimensional (3D) CDW phase at temperatures of less than 220 K. This study shows the dimension evolution of CDW phases in one CDW system and their stabilized mechanisms in different temperature regimes.

[1] N. N. Quyen, C. W. Luo, et al., Nature Communications 15, 2386 (2024)