Modification and manipulation of charge density waves in 2D materials

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Abstract:

Two-dimensional (2D) materials exhibit a fascinating variety of exotic electronic states, including charge density waves (CDWs) observed in transition metal dichalcogenides (TMDs). While the Peierls distortion explains well CDWs in one dimension, understanding their origin in higher dimensions remains a challenge. Beside the question of the physical origin, the control and manipulation of CDW in TMDs offers a rich playground for fundamental physics and possible applications.

Here, recent results will be presented on the modification and manipulation of CDW studied by combining scanning tunneling microscopy and density functional theory calculations. I will show how alkali intercalation can induce a transition from 3D to 2D CDW [1], and how a local excitation with an STM tip can be used to manipulate the CDW in a monolayer TMD [2] (see Figure). These findings showcase the ability to tailor CDWs in 2D materials through different methods.

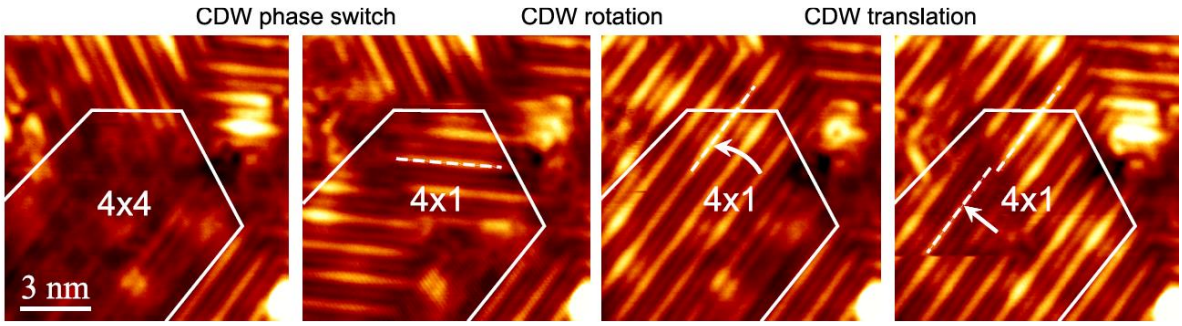

Figure 1 : Manipulation of CDW in VTe_2 using an STM tip: transition from 4×4 to 4×1, rotated and translated 4×1 CDW.

References:

[1] U. Chazarin et al., Adv. Mater. Interfaces, 2201680 (2023).

[2] U. Chazarin et al., Nano Letters, 24, 3470 (2024).