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Van derWaals-coupled electronic states in incommensurate double-walled carbon nanotubes CHENHAO JIN, Department of Physics, UC Berkeley, KAIHUI LIU, Department of Physics, Peking University, XIAOPING HONG, JIHOON KIM, ALEX ZETTLE, Department of Physics, UC Berkeley, ENGE WANG, International Center for Quantum Materials and Collaborative Innovation Center of Quantum Matter, Peking University, FENG WANG, Department of Physics, UC Berkeley — In two-dimensional materials consisting of elements without finite unit cell, such as twisted graphene bilayer or graphene on boron nitride, the incommensurate van der Waals coupling can give rise to emerging physics like Van Hove singularities, pseudospin-mixing potential and Hofstadter butterflies. However, their 1D counterpart, incommensurate double-walled carbon nanotube (DWNT), is conventionally believed to have negligible electron hybridization due to destructive interference. Here we for the first time demonstrate strong and chirality-dependent intertube electronic coupling in DWNTs, which can be well described by a zone folding model of twisted and "stretched" graphene bilayers. Our results demonstrate that incommensurate van der Waals interactions can be important for engineering the electronic structure and optical properties of one-dimensional materials.

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