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Atomically Resolved STM Characterization of the 3-D Dirac Semimetal Cd_3As_2 CHRISTOPHER BUTLER, YI TSENG, Dept. of Physics, National Taiwan University, CHENG-RONG HSING, IAMS, Academia Sinica, YU-MI WU, Dept. of Physics, National Taiwan University, RAMAN SANKAR, CCMS, National Taiwan University, MEI-FANG WANG, Dept. of Physics, National Taiwan University, CHING-MING WEI, IAMS, Academia Sinica, FANG-CHENG CHOU, CCMS, National Taiwan University, MINN-TSONG LIN, Dept. of Physics, National Taiwan University — Dirac semimetals such as Cd_3As_2 are a recently discovered class of materials which host three-dimensional linear dispersion around point-like band crossings in the bulk Brillouin zone, and hence represent three-dimensional analogues of graphene. This electronic phase is enabled by specific crystal symmetries: In the case of Cd_3As_2, a C_4 rotational symmetry associated with its peculiar corkscrew arrangement of systematic Cd vacancies. Although this arrangement underpins the current crystallographic understanding of Cd_3As_2, and all its theoretical implications, it is strangely absent in surface microscopic investigations reported previously. Here we use a combined approach of scanning tunneling microscopy and ab initio calculations to show that the currently held crystallographic model of Cd_3As_2 is indeed predictive of a periodic zig-zag superstructure at the (112) surface, which we observe in scanning tunneling microscopy images. This helps to reconcile the current state of microscopic surface observations with the prevailing crystallographic and theoretical models.

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