

Erratum: Programmable Quantum Anomalous Hall Insulator in Twisted Crystalline Flatbands [Phys. Rev. X **16**, 011015 (2026)]

Wenxuan Wang¹, Yijie Wang, Zaizhe Zhang, Zihao Huo², Gengdong Zhou³, Shu Zhang, Kenji Watanabe⁴, Takashi Taniguchi⁵, Xiaoxia Yang, Qing Dai, X. C. Xie, Kaihui Liu, Zhida Song, and Xiaobo Lu⁶



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In the article, an outdated bibliography file was inadvertently uploaded during the final submission process. As a result, the author lists in 26 references do not accurately reproduce the author lists of the cited publications. The affected entries are Refs. [2,8,10,12,18,24–34,37–39,41–43,45,49,50], and [51].

The cited works themselves are the intended publications; the errors are confined to the bibliographic author information. These corrections do not affect the scientific content, results, or conclusions of the article.

The corrected reference list, Refs. [1–51], is as follows:

- [1] R. Bistritzer and A. H. MacDonald, *Moiré bands in twisted double-layer graphene*, *Proc. Natl. Acad. Sci. U.S.A.* **108**, 12233 (2011).
- [2] Y. Cao, V. Fatemi, A. Demir, S. Fang, S. L. Tomarken, J. Y. Luo, J. D. Sanchez-Yamagishi, K. Watanabe, T. Taniguchi, E. Kaxiras *et al.*, *Correlated insulator behaviour at half filling in magic-angle graphene superlattices*, *Nature (London)* **556**, 80 (2018).
- [3] Y. Cao, V. Fatemi, S. Fang, K. Watanabe, T. Taniguchi, E. Kaxiras, and P. Jarillo-Herrero, *Unconventional superconductivity in magic-angle graphene superlattices*, *Nature (London)* **556**, 43 (2018).
- [4] Z. Hao, A. M. Zimmerman, P. Ledwith, E. Khalaf, D. H. Najafabadi, K. Watanabe, T. Taniguchi, A. Vishwanath, and P. Kim, *Electric field-tunable superconductivity in alternating-twist magic-angle trilayer graphene*, *Science* **371**, 1133 (2021).
- [5] J. M. Park, Y. Cao, K. Watanabe, T. Taniguchi, and P. Jarillo-Herrero, *Tunable strongly coupled superconductivity in magic-angle twisted trilayer graphene*, *Nature (London)* **590**, 249 (2021).
- [6] Y. Cao, J. M. Park, K. Watanabe, T. Taniguchi, and P. Jarillo-Herrero, *Pauli-limit violation and re-entrant superconductivity in moiré graphene*, *Nature (London)* **595**, 526 (2021).
- [7] J. M. Park, Y. Cao, L. Q. Xia, S. Sun, K. Watanabe, T. Taniguchi, and P. Jarillo-Herrero, *Robust superconductivity in magic-angle multilayer graphene family*, *Nat. Mater.* **21**, 877 (2022).
- [8] G. W. Burg, E. Khalaf, Y. Wang, K. Watanabe, T. Taniguchi, and E. Tutuc, *Emergence of correlations in alternating twist quadrilayer graphene*, *Nat. Mater.* **21**, 884 (2022).
- [9] Y. Zhang, R. Polshi, C. Lewandowski, A. Thomson, Y. Peng, Y. Choi, H. Kim, K. Watanabe, T. Taniguchi, J. Alicea *et al.*, *Promotion of superconductivity in magic-angle graphene multilayers*, *Science* **377**, 1538 (2022).
- [10] H. Polshyn, Y. Zhang, M. A. Kumar, T. Soejima, P. Ledwith, K. Watanabe, T. Taniguchi, A. Vishwanath, M. P. Zaletel, and A. F. Young, *Topological charge density waves at half integer filling of a moiré superlattice*, *Nat. Phys.* **18**, 42 (2022).
- [11] S. Xu, M. M. Al Ezzi, N. Balakrishnan, A. Garcia-Ruiz, B. Tsim, C. Mullan, J. Barrier, N. Xin, B. A. Piot, T. Taniguchi *et al.*, *Tunable van Hove singularities and correlated states in twisted monolayer–bilayer graphene*, *Nat. Phys.* **17**, 619 (2021).
- [12] S. Chen, M. He, Y. Zhang, V. Hsieh, Z. Fei, K. Watanabe, T. Taniguchi, D. H. Cobden, X. Xu, C. R. Dean, and M. Yankowitz, *Electrically tunable correlated and topological states in twisted monolayer–bilayer graphene*, *Nat. Phys.* **17**, 374 (2021).
- [13] H. Polshyn, J. Zhu, M. A. Kumar, Y. Zhang, F. Yang, C. L. Tschirhart, M. Serlin, K. Watanabe, T. Taniguchi, A. H. MacDonald *et al.*, *Electrical switching of magnetic order in an orbital Chern insulator*, *Nature (London)* **588**, 66 (2020).
- [14] Y. Cao, D. Rodan-Legrain, O. Rubies-Bigorda, J. M. Park, K. Watanabe, T. Taniguchi, and P. Jarillo-Herrero, *Tunable correlated states and spin-polarized phases in twisted bilayer-bilayer graphene*, *Nature (London)* **583**, 215 (2020).
- [15] X. Liu, Z. Hao, E. Khalaf, J. Y. Lee, Y. Ronen, H. Yoo, D. H. Najafabadi, K. Watanabe, T. Taniguchi, A. Vishwanath *et al.*, *Tunable spin-polarized correlated states in twisted double bilayer graphene*, *Nature (London)* **583**, 221 (2020).
- [16] C. Shen, Y. Chu, Q. Wu, N. Li, S. Wang, Y. Zhao, J. Tang, J. Liu, J. Tian, K. Watanabe *et al.*, *Correlated states in twisted double bilayer graphene*, *Nat. Phys.* **16**, 520 (2020).
- [17] M. He, Y. Li, J. Cai, Y. Liu, K. Watanabe, T. Taniguchi, X. Xu, and M. Yankowitz, *Symmetry breaking in twisted double bilayer graphene*, *Nat. Phys.* **17**, 26 (2021).
- [18] R. Su, D. Waters, B. Zhou, K. Watanabe, T. Taniguchi, Y. Zhang, M. Yankowitz, and J. Folk, *Moiré-driven topological electronic crystals in twisted graphene*, *Nature (London)* **637**, 1084 (2025).

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- [19] D. Waters, E. Thompson, E. Arreguin-Martinez, M. Fujimoto, Y. Ren, K. Watanabe, T. Taniguchi, T. Cao, D. Xiao, and M. Yankowitz, *Mixed-dimensional moiré systems of twisted graphitic thin films*, *Nature (London)* **620**, 750 (2023).
- [20] S. Yang, Z. C. Gu, K. Sun, and S. D. Sarma, *Topological flat band models with arbitrary Chern numbers*, *Phys. Rev. B* **86**, 241112(R) (2012).
- [21] J. Liu, Z. Ma, J. Gao, and X. Dai, *Quantum valley Hall effect, orbital magnetism, and anomalous Hall effect in twisted multilayer graphene systems*, *Phys. Rev. X* **9**, 031021 (2019).
- [22] J. Wang and Z. Liu, *Hierarchy of ideal flatbands in chiral twisted multilayer graphene models*, *Phys. Rev. Lett.* **128**, 176403 (2022).
- [23] P. J. Ledwith, A. Vishwanath, and E. Khalaf, *Family of ideal Chern flatbands with arbitrary Chern number in chiral twisted graphene multilayers*, *Phys. Rev. Lett.* **128**, 176404 (2022).
- [24] T. Han, Z. Lu, G. Scuri, J. Sung, J. Wang, T. Han, K. Watanabe, T. Taniguchi, L. Fu, H. Park, and L. Ju, *Orbital multiferroicity in pentalayer rhombohedral graphene*, *Nature (London)* **623**, 41 (2023).
- [25] T. Han, Z. Lu, G. Scuri, J. Sung, J. Wang, T. Han, K. Watanabe, T. Taniguchi, H. Park, and L. Ju, *Correlated insulator and Chern insulators in pentalayer rhombohedral-stacked graphene*, *Nat. Nanotechnol.* **19**, 181 (2024).
- [26] T. Arp, O. Sheekey, H. Zhou, C. L. Tshirhart, C. L. Patterson, H. M. Yoo, L. Holleis, E. Redekop, G. Babikyan, T. Xie *et al.*, *Intervalley coherence and intrinsic spin orbit coupling in rhombohedral trilayer graphene*, *Nat. Phys.* **20**, 1413 (2024).
- [27] K. Liu, J. Zheng, Y. Sha, B. Lyu, F. Li, Y. Park, Y. Ren, K. Watanabe, T. Taniguchi *et al.*, *Spontaneous broken-symmetry insulator and metals in tetralayer rhombohedral graphene*, *Nat. Nanotechnol.* **19**, 188 (2024).
- [28] W. Zhou, J. Ding, J. Hua, L. Zhang, K. Watanabe, T. Taniguchi, W. Zhu, and S. Xu, *Layer-polarized ferromagnetism in rhombohedral multilayer graphene*, *Nat. Commun.* **15**, 2597 (2024).
- [29] Y. Sha, J. Zheng, K. Liu, H. Du, K. Watanabe, T. Taniguchi, J. Jia, Z. Shi, R. Zhong, and G. Chen, *Observation of a Chern insulator in crystalline ABCA-tetralayer graphene with spin-orbit coupling*, *Science* **384**, 414 (2024).
- [30] T. Han, Z. Lu, Y. Yao, J. Yang, J. Seo, C. Yoon, K. Watanabe, T. Taniguchi, L. Fu, F. Zhang, and Long Ju, *Large quantum anomalous Hall effect in spin-orbit proximitized rhombohedral graphene*, *Science* **384**, 647 (2024).
- [31] T. Han, Z. Lu, Z. Hadjri, L. Shi, Z. Wu, Wei Xu, Y. Yao, A. A. Cotton, O. S. Sedeh, H. Weldeyesus *et al.*, *Signatures of chiral superconductivity in rhombohedral graphene*, *Nature (London)* **643**, 654 (2025).
- [32] J. Yang, X. Shi, S. Ye, C. Yoon, Z. Lu, V. Kakani, T. Han, J. Seo, L. Shi, K. Watanabe *et al.*, *Impact of spin-orbit coupling on superconductivity in rhombohedral graphene*, *Nat. Mater.* **24**, 1058 (2025).
- [33] H. Zhou, T. Xie, A. Ghazaryan, T. Holder, J. R. Ehrets, E. M. Spanton, T. Taniguchi, K. Watanabe, E. Berg, M. Serbyn *et al.*, *Half and quarter-metals in rhombohedral trilayer graphene*, *Nature (London)* **598**, 429 (2021).
- [34] G. Chen, L. Jiang, S. Wu, B. Lyu, H. Li, B. L. Chittari, K. Watanabe, T. Taniguchi, Z. Shi, J. Jung *et al.*, *Evidence of a gate tunable Mott insulator in a trilayer graphene moiré superlattice*, *Nat. Phys.* **15**, 237 (2019).
- [35] G. Chen, A. L. Sharpe, P. Gallagher, I. T. Rosen, E. J. Fox, L. Jiang, B. Lyu, H. Li, K. Watanabe, T. Taniguchi *et al.*, *Signatures of tunable superconductivity in a trilayer graphene moiré superlattice*, *Nature (London)* **572**, 215 (2019).
- [36] G. Chen, A. L. Sharpe, E. J. Fox, Y. H. Zhang, S. Wang, L. Jiang, B. Lyu, H. Li, K. Watanabe, T. Taniguchi *et al.*, *Tunable correlated Chern insulator and ferromagnetism in a moiré superlattice*, *Nature (London)* **579**, 56 (2020).
- [37] Z. Lu, T. Han, Y. Yao, A. P. Reddy, J. Yang, J. Seo, K. Watanabe, T. Taniguchi, L. Fu, and L. Ju, *Fractional quantum anomalous Hall effect in multilayer graphene*, *Nature (London)* **626**, 759 (2024).
- [38] Z. Lu, T. Han, Y. Yao, Z. Hadjri, J. Yang, J. Seo, L. Shi, S. Ye, K. Watanabe, T. Taniguchi *et al.*, *Extended quantum anomalous Hall states in graphene/hBN moiré superlattices*, *Nature (London)* **637**, 1090 (2025).
- [39] S. H. Aronson, T. Han, Z. Lu, Y. Yao, J. P. Butler, K. Watanabe, T. Taniguchi, L. Ju, and R. C. Ashoori, *Displacement field-controlled fractional Chern insulators and charge density waves in a graphene/hBN moiré superlattice*, *Phys. Rev. X* **15**, 031026 (2025).
- [40] D. Waters, A. Okounkova, R. Su, B. Zhou, J. Yao, K. Watanabe, T. Taniguchi, X. Xu, Y. H. Zhang, J. Folk, and M. Yankowitz, *Chern insulators at integer and fractional filling in moiré pentalayer graphene*, *Phys. Rev. X* **15**, 011045 (2025).
- [41] Y. Choi, Y. Choi, M. Valentini, C. L. Patterson, L. F. W. Holleis, O. I. Sheekey, H. Stoyanov, X. Cheng, T. Taniguchi, K. Watanabe *et al.*, *Superconductivity and quantized anomalous Hall effect in rhombohedral graphene*, *Nature (London)* **639**, 342 (2025).
- [42] J. Xie, Z. Huo, X. Lu, Z. Feng, W. Wang, Q. Yang, K. Watanabe, T. Taniguchi, K. Liu, Z. Song *et al.*, *Tunable fractional Chern insulators in rhombohedral graphene superlattices*, *Nat. Mater.* **24**, 1042 (2025).
- [43] Z. Wang, Q. Liu, X. Han, Z. Li, W. Zhao, Z. Qu, C. Han, K. Watanabe, T. Taniguchi, Z. V. Han *et al.*, *Electrical switching of Chern insulators in moiré rhombohedral heptalayer graphene*, *arXiv:2503.00837*.
- [44] S. J. Hong, D. Wang, D. Wulferding, P. Lemmens, and R. J. Haug, *Twisted double ABC-stacked trilayer graphene with weak interlayer coupling*, *Phys. Rev. B* **105**, 205404 (2022).
- [45] M. L. Perrin, A. Jayaraj, B. Ghawri, K. Watanabe, T. Taniguchi, D. Passerone, M. Calame, and J. Zhang, *Electric field tunable bandgap in twisted double trilayer graphene*, *npj 2D Mater. Appl.* **8**, 14 (2024).
- [46] See Supplemental Material at <http://link.aps.org/supplemental/10.1103/7m1b-hxy8> for methods of device fabrication, transport measurements, twist angle determination, the continuum model, Landau-Ginzburg theory for first order transitions, Hartree-Fock calculations, si and supplemental texts with supplemental data.
- [47] Z. Feng, W. Wang, Y. You, Y. Chen, K. Watanabe, T. Taniguchi, C. Liu, K. Liu, and X. Lu, *Rapid infrared imaging of rhombohedral graphene*, *Phys. Rev. Appl.* **23**, 034012 (2025).

- [48] C. Rubio-Verdú, S. Turkel, Y. Song, L. Klebl, R. Samajdar, M. S. Scheurer, J. W. F. Venderbos, K. Watanabe, T. Taniguchi, H. Ochoa *et al.*, *Moiré nematic phase in twisted double bilayer graphene*, [Nat. Phys. **18**, 196 \(2022\)](#).
- [49] Y. Xu, S. Liu, D. A. Rhodes, K. Watanabe, T. Taniguchi, J. Hone, V. Elser, K. F. Mak, and J. Shan, *Correlated insulating states at fractional fillings of moiré superlattices*, [Nature \(London\) **587**, 214 \(2020\)](#).
- [50] E. C. Regan, D. Wang, C. Jin, M. I. B. Utama, B. Gao, X. Wei, S. Zhao, W. Zhao, Z. Zhang, K. Yumigeta *et al.*, *Mott and generalized Wigner crystal states in WSe₂/WS₂ moiré superlattices*, [Nature \(London\) **579**, 359 \(2020\)](#).
- [51] J. Dong, L. Liu, J. Zhu, Z. Pan, Y. Hong, F. Wang, Z. Ren, Z. Jia, K. Watanabe, T. Taniguchi *et al.*, *Observation of integer and fractional Chern insulators in high Chern number flatbands*, .