

# Full Slonczewski-Weiss-McClure parametrization of twisted bilayer graphene

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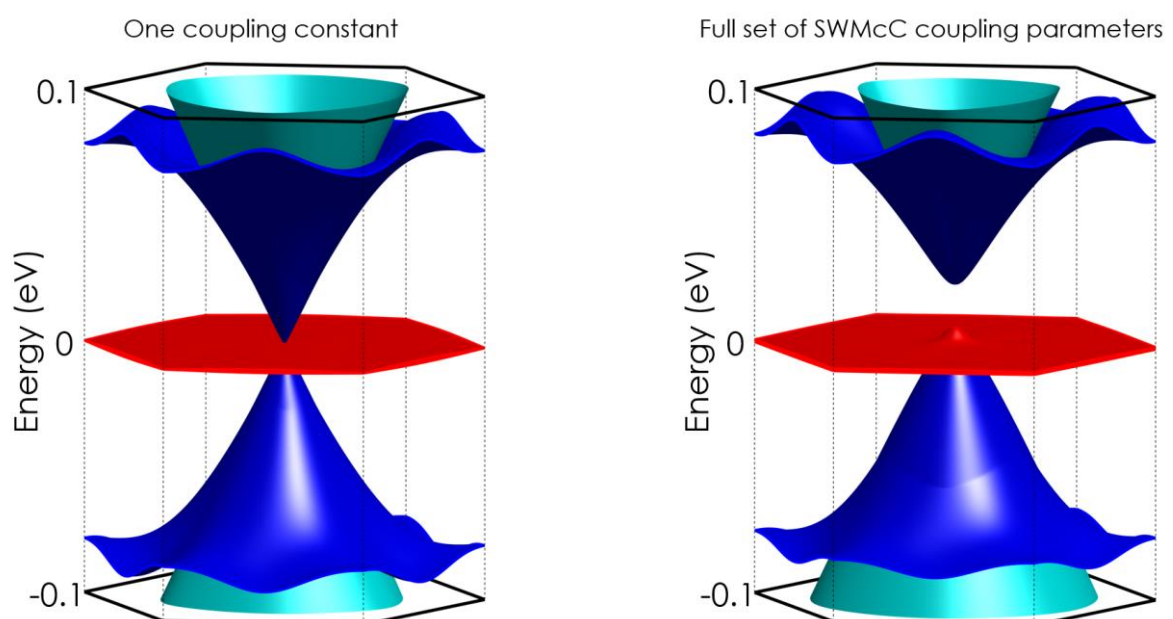
The origin of strongly correlated phenomena in magic-angle twisted bilayer graphene is closely related with the formation of nearly flat bands in the electronic dispersion [1]. The commonly used Bistritzer-McDonald (BM) model [2,3] parametrises the twisted interface using only one coupling constant and predicts the formation of such dispersionless bands. However, other spectral features observed in experiments, such as electron-hole asymmetry, remain unexplained under this model.

In this talk, we present linear-in-momentum corrections to the BM model, that accounts for the interlayer tunnelling processes prescribed by the full set of Slonczewski-Weiss McClure (SWMcC) coupling parameters of Bernal bilayer graphene [4]. Using this continuum model, the band structure exhibits electron-hole asymmetry and a clear spectral isolation of the flat bands in the conduction side [5], which agrees with other theoretical approaches, including tight-binding and density functional theory.

## References

- [1] Y. Cao, V. Fatemi, A. Demir, S. Fang, S. L. Tomarken, J. Y. Luo, J. D. Sanchez-Yamagishi, K. Watanabe, T. Taniguchi, E. Kaxiras, R. C. Ashoori, and P. Jarillo-Herrero, *Nature* 556, (2018) 80.
- [2] J. M. B. Lopes dos Santos, N. M. R. Peres, and A. H. Castro Neto, *Phys. Rev. Lett.* 99, (2007) 256802.
- [3] R. Bistritzer and A. H. MacDonald, *PNAS*, 108, (2011) 12233.
- [4] M. Koshino and E. McCann, *Rep. prog. Phys.*, 76, (2013) 056503.
- [5] A. Garcia-Ruiz, H. Deng, V. V. Enaldiev, and V. I. Fal'ko, arXiv:2105.00086 (2021).

## Figures



**Figure 1:** Band structure of magic-angle twisted bilayer graphene using the BM model (left) and using the full set of SWMcC coupling parameters (right).