MAGIC ANGLES FOR A MODEL OF TWISTED BILAYER GRAPHENE

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Magic angles are a hot topic in condensed matter physics: when two sheets of graphene are twisted by those angles the resulting material is superconducting. I will present a very simple operator whose spectral properties are thought to determine which angles are magical. It comes from a 2019 PR Letter by Tarnopolsky–Kruchkov–Vishwanath. The mathematics behind this is an elementary blend of representation theory (of the Heisenberg group in characteristic three), Jacobi theta functions and spectral instability of non-self-adjoint operators (involving Hörmander's bracket condition in a very simple setting). Recent mathematical progress also includes the proof of existence of generalized magic angles and computer assisted proofs of existence of real ones (Luskin–Watson, 2021). The results will be illustrated by colourful numerics which suggest many open problems (joint work with S Becker, M Embree and J Wittsten, 2020).