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Band Engineering for Quantum Simulation in Circuit QED[1]

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The field of circuit QED has emerged as a rich platform for both quantum computation and quantum simulation. Lattices of coplanar waveguide (CPW) resonators realize artificial photonic materials in the tight-binding limit. In combination with qubit-mediated photon-photon interactions, these systems can be used to study dynamical phase transitions and many-body phenomena in driven-dissipative systems. In this talk, we will show how graph-theory and graph-level operations can be used to tailor the single-particle band structures of such systems. In particular, we will show that the process of taking a line graph produces controllably gapped flat bands at -2 and that subdividing all graph edges produces Dirac cones from formerly quadratic band edges and chiral flat bands at zero energy.

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