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Hyperbolic band theory

The notions of Bloch wave, crystal momentum, and energy bands are commonly regarded as unique features of crystalline materials with commutative translation symmetries. Motivated by the recent realization of hyperbolic lattices in circuit QED, I will present a hyperbolic generalization of Bloch theory, based on ideas from Riemann surface theory and algebraic geometry. The theory is formulated despite the non-Euclidean nature of the problem and concomitant absence of commutative translation symmetries. The general theory will be illustrated by examples of explicit computations of hyperbolic Bloch wavefunctions and bandstructures.