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Section:

9. Ordinary Differential Equations and Dynamical Systems

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Tkachenko, Vadim, Ben-Gurion University of the Negev, Beer-Sheva, Israel
Typical spectra of Dirac operators with skew-symmetric periodic potential matrices
We consider Dirac operators

$$L = J\frac{d}{dx} + Q(x)\,, \quad x \in \mathbf{R}\,,$$

where J and $Q(x)$ are 2×2 matrices, $J = \text{const}$, with $J^2 = -\text{id}\,$, $JQ(x) + Q(x)J = 0\,$, $Q(x+\pi) = Q(x)$. It is well known that if $Q(x) = Q^*(x)$, then L is a selfadjoint operator, its spectrum is formed by a system of real spectral bands separated by gaps, and for a typical operator all spectral gaps are open.

We study operators L with skew-symmetric potential matrices $Q(x) = -Q^*(x)$. Their spectra include the real axis and, in addition, a system of closed analytic arcs. One part of these arcs (spectral spines) intersect the real axis, another part is formed by arcs disjoint with it.

We prove that for a typical Dirac operator with $Q(x) = -Q^*(x)$ all possible spectral spines do not degenerate, and additional spectral arcs do not intersect the real axis and each other. The proof is based on the study of small perturbations of Hill's discriminants.