İSTANBUL ANALYSIS SEMINARS

ASYMPTOTICS OF SPECTRAL GAPS OF 1D DIRAC OPERATOR WITH TWO EXPONENTIAL TERMS POTENTIAL

Berkay ANAHTARCI

Sabancı University
Faculty of Engineering and Natural Sciences

Abstract: The one-dimensional Dirac operator

$$L = i\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\frac{d}{dx} + \begin{pmatrix} 0 & P(x) \\ Q(x) & 0 \end{pmatrix}, \quad P, Q \in L^2([0,\pi]),$$

considered on $[0,\pi]$ with periodic and antiperiodic boundary conditions, has discrete spectra. For large enough $|n|$, $n \in \mathbb{Z}$, there are two (counted with multiplicity) eigenvalues λ_n^-, λ_n^+ (periodic if n is even, or antiperiodic if n is odd) such that $|\lambda_n^\pm - n| < 1/2$.

We study the asymptotics of spectral gaps $\gamma_n = \lambda_n^+ - \lambda_n^-$ in the case

$$P(x) = ae^{-2ix} + Ae^{2ix}, \quad Q(x) = be^{-2ix} + Be^{2ix},$$

where a, A, b, B are nonzero complex numbers. We show, for large enough m, that $\gamma_{\pm 2m} = 0$ and

$$\gamma_{2m+1} = \pm 2\frac{\sqrt{(Ab)^m(aB)^{m+1}}}{4^{2m}(m!)^2}\left[1 + O\left(\frac{\log^2 m}{m^2}\right)\right],$$

$$\gamma_{-(2m+1)} = \pm 2\frac{\sqrt{(Ab)^{m+1}(aB)^m}}{4^{2m}(m!)^2}\left[1 + O\left(\frac{\log^2 m}{m^2}\right)\right].$$

The talk is based on joint results with Plamen Djakov.

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