Abstract

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"Sharp bounds for the eigenvalues of the angular Kerr-Newman-Dirac operator"

The angular part of the Dirac equation in the Kerr-Newman metric is the block operator matrix

$$\mathcal{A} = \begin{pmatrix} -am\cos\theta & \frac{\mathrm{d}}{\mathrm{d}\theta} + \frac{\kappa}{\sin\theta} + am\cos\theta \\ \frac{\mathrm{d}}{\mathrm{d}\theta} + \frac{\kappa}{\sin\theta} + am\cos\theta & am\cos\theta \end{pmatrix}$$

which acts on functions in $L_2(0,\pi)^2$. Here $\kappa \in \mathbb{Z}+\frac{1}{2}$ and a, m and ω are real parameters. It can be shown that this operator has only point spectrum. Analytic formulae for the eigenvalues are available only in special cases. I will present some analytic bounds on the eigenvalues and then I will show how the so-called second order spectrum allows us to find numerical approximations of the eigenvalues with guaranteed error bounds. It is remarkable how in several cases rather coarse analytic bounds improve considerably a priori numeric bounds.