Essential self-adjointness of symmetric first-order differential systems and confinement of Dirac particles on bounded domains in $\mathbb{R}^d$

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Abstract

We prove essential self-adjointness of Dirac operators with Lorentz scalar potentials which grow sufficiently fast near the boundary $\partial\Omega$ of the spatial domain $\Omega \subset \mathbb{R}^d$. On the way, we first consider general symmetric first order differential systems, for which we identify a new, large class of potentials, called scalar potentials, ensuring essential self-adjointness. Furthermore, using the supersymmetric structure of the Dirac operator in the two dimensional case, we prove confinement of Dirac particles, i.e. essential self-adjointness of the operator, solely by magnetic fields $\mathcal{B}$ assumed to grow, near $\partial\Omega$, faster than $1/(2\,\mathrm{dist}(x, \partial\Omega)^2)$. This is joint work with Irina Nenciu and Ryan Obermeyer.