

Quantum Physics

Investigating the Spectral Geometry of a Soft Wall

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The idealized theory of quantum vacuum energy density is a beautiful application of the spectral theory of differential operators with boundary conditions, but its conclusions are physically unacceptable. A more plausible model of a reflecting boundary that stays within linear spectral theory confines the waves by a steeply rising potential function, which can be taken as a power of one coordinate, z^α . We report investigations of this model with considerable student involvement. An exact analytical solution with some numerics for $\alpha=1$ and an asymptotic (semiclassical) analysis of a related problem for $\alpha=2$ are presented.

Comments: 16 pages, 4 figures; International Conference on Spectral Geometry (Dartmouth, 2010). Revision (final submission to Proc. Symp. Pure Math.) has minor updates and corrections

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