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12. Probability and Statistics

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On some energy inequalities

We consider the Schrödinger operator $H = -\frac{\Delta}{2} + q$ in a bounded domain D in R^d, $d \geq 3$, with q in Kato class $K^d(D)$ and finite gauge $g(x) = E_x[exp \int_0^\tau q(X_s)ds]$, where (X_t) is a Brownian motion and τ the first exit time of the Brownian motion (X_t) from the domain D. Let K and G denote the Green operators in D for H and $\frac{\Delta}{2}$, respectively. We prove that there is a positive constant α such that

$$\frac{1}{\alpha}(Gf, f) \leq (Kf, f) \leq \alpha(Gf, f),$$

where f is a real, measurable function for which $(G|f|, |f|)$ is finite. As a direct consequence of this double inequality we have that the potential Gf is in the Sobolev space $H_0^1(D)$ if and only if $Kf \in H_0^1(D)$.

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