Estimates of kernels and ground states for Schrödinger semigroups

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We consider the Schrödinger operator of the form $H = -\Delta + V$ acting in $L^2(\mathbb{R}^d, dx)$, $d \geq 1$, where the potential $V : \mathbb{R}^d \to [0, \infty)$ is a locally bounded function. The corresponding Schrödinger semigroup $\left\{e^{-tH} : t \geq 0\right\}$ consists of integral operators, i.e.

$$e^{-tH} f(x) = \int_{\mathbb{R}^d} u_t(x, y) f(y) dy, \quad f \in L^2(\mathbb{R}^d, dx), \ t > 0.$$

In first part of talk i will present new estimates for heat kernel of $u_t(x, y)$. Our results show the contribution of the potential is described separately for each spatial variable, and the interplay between the spatial variables is seen only through the Gaussian kernel.

This estimates will be presented on two common classes of potentials. For confining potentials we get two sided estimates and for decaying potentials we get new upper estimate.

Methods we used to estimated kernel of semigroup allow to easily obtain sharp estimates of ground state for slowly varying potentials.

References

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[2] M. Baraniewicz, Estmates of ground state for classical Schrödinger operator, *arXiv:2407.09267*.