

GAUSSIAN BOUNDS FOR THE HEAT KERNEL ASSOCIATED TO PROLATE SPHEROIDAL WAVE
FUNCTIONS WITH APPLICATIONS

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Gaussian upper and lower bounds are established for the heat kernel associated to the prolate spheroidal wave functions (PSWFs) of order zero. This result follows from a general principle that relates semi-groups associated to a self-adjoint operator and its perturbation and their kernels. As an application of this general result we also establish the Gaussian bounds for the heat kernels associated to generalized univariate PSWFs and PSWFs on the unit ball in \mathbb{R}^d . Further, we develop the related to the PSWFs of order zero smooth functional calculus, which in turn is the necessary ground work in developing the theory of Besov and Triebel-Lizorkin spaces associated with the PSWFs. One of our main results on Besov and Triebel-Lizorkin spaces associated to the PSWFs asserts that they are the same as the Besov and Triebel-Lizorkin spaces generated by the Legendre operator.

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