

Estimates of the heat kernel on differential forms and the boundedness of the Riesz transform

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We study the boundedness of the Riesz transform $d\Delta^{-1/2}$ on complete non-compact manifolds. A classical result is that it is bounded on $L^p(M)$ for $1 < p < \infty$ if the Ricci curvature is non-negative, and the proof of this relies on gaussian estimate of the heat kernel on differential 1-forms, which holds if Ricci is non-negative. Here we extend the gaussian estimate to a more general class of manifolds with the negative part of Ricci in $L^{n/2}$, and using this we prove boundedness results for the Riesz transform on these manifolds.