

Abstract

In this talk, we discuss the global behaviors of the heat kernel and Green's function on the complete manifold with nonnegative Ricci curvature. We first obtain sharp two-side Gaussian bounds for the heat kernel that sharpens the well-known Li-Yau's two-side bounds, based on the sharp Li-Yau's Harnack inequality on such a manifold. As an application, we get the optimal gradient and Laplacian estimates on the heat kernel with our new Hamilton's estimates of positive bounded solutions. Next, when the manifold has Euclidean volume growth, we obtain the new pointwise lower and upper bounds for the heat kernel in term of a natural geometric quantity that characterizes the decay rate of the normalized Bishop–Gromov quantities. And as applications of the two side bounds, we obtain the large-time asymptotics of the heat kernel, which extends the results of P. Li and Li-Tam-Wang, and the large-scale behavior of Green's function, which extends a result of Colding-Minicozzi, on the complete manifold with nonnegative Ricci curvature and Euclidean volume growth.