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*Old and New Morrey Spaces with Heat Kernel Bounds*

In this talk I will address my work joint with D. Xuong and L. Yan. More precisely, given $p \in [1, \infty)$ and $\lambda \in (0, n)$, we discuss Morrey space $\mathrm{L}^{p,\lambda}(\mathbb{R}^n)$ of all locally integrable complex-valued functions $f$ on $\mathbb{R}^n$ such that for every open Euclidean ball $B \subset \mathbb{R}^n$ with radius $r_B$ there are numbers $C = C(f)$ (depending on $f$) and $c = c(f, B)$ (relying upon $f$ and $B$) satisfying

$$r_B^{-\lambda} \int_B |f(x) - c|^p \, dx \leq C$$

and derive old and new, two essentially different cases arising from either choosing $c = f_B = |B|^{-1} \int_B f(y) \, dy$ or replacing $c$ by $P_{t_B}(x) = \int_{t_B} p_{t_B}(x, y) f(y) \, dy$—where $t_B$ is scaled to $r_B$ and $p_t(\cdot, \cdot)$ is the kernel of the infinitesimal generator $L$ (taking the Schroedinger operator as a special one) of an analytic semigroup $\{e^{-tL}\}_{t \geq 0}$ on $\mathrm{L}^2(\mathbb{R}^n)$. Consequently, we are led to simultaneously characterize the old and new Morrey spaces, but also to show that for a suitable operator $L$, the new Morrey space is equivalent to the old one.