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Heat kernel generated frames in the setting of Dirichlet spaces

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Wavelet bases and frames consisting of band limited functions of nearly exponential localization on Rd are a powerful tool in harmonic analysis by making various spaces of functions and distributions more accessible for study and utilization, and providing sparse representation of natural function spaces (e.g. Besov spaces) on Rd. Such frames are also available on the sphere and in more general homogeneous spaces, on the interval and ball. The purpose of this article is to develop band limited well-localized frames in the general setting of Dirichlet spaces with doubling measure and a local scale-invariant Poincar\'e inequality which lead to heat kernels with small time Gaussian bounds and H\"older continuity. As an application of this construction, band limited frames are developed in the context of Lie groups or homogeneous spaces with polynomial volume growth, complete Riemannian manifolds with Ricci curvature bounded from below and satisfying the volume doubling property, and other settings. The new frames are used for decomposition of Besov spaces in this general setting.

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