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Anisotropic singular integrals and rectifiability

Since the work of Mattila and Preiss in 1995, it's been known that for a Radon measure with reasonable density assumptions, the almost everywhere existence of principal values of the Riesz transform is equivalent to the measure being rectifiable. In ongoing work with M. Goering, T. Toro, and B. Wilson, we prove a version of this result of Mattila and Preiss in a rough Riemannian setting. In this talk, we discuss the geometric techniques used in proving the almost everywhere existence of principal values for smooth Calderon Zygmund kernels for rectifiable measures, even when the kernel is not of convolution type.