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A weighted rigidity theorem for Perelman's entropy on complete Riemannian manifolds

Abstract

Abstract: In his 2002 remarkable preprint, G. Perelman introduced the mysterious  $W$ -entropy functional for the conjugate heat equation and proved its monotonicity along the Ricci flow. Inspired by Perelman's pioneering work, we introduce the  $W$ -entropy functional associated with the heat equation for the weighted Laplacian on complete Riemannian manifolds. Under the non-negativity assumption on the Bakry-Emery Ricci curvature, we prove the monotonicity of  $W$ -entropy. Moreover, we prove a weighted rigidity theorem for the  $W$ -entropy on complete Riemannian manifolds.