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Ricci curvature and martingales

We generalize the classical Bochner formula for the heat flow on a manifold $M$ to martingales on the path space $PM$, and develop a formalism to compute evolution equations for martingales on path space. We see that our Bochner formula on $PM$ is related to two sided bounds on Ricci curvature in much the same manner as the classical Bochner formula on $M$ is related to lower bounds on Ricci curvature. This establishes a new link between geometry and stochastic analysis, and provides a crucial new tool for the study of Einstein metrics and Hamilton’s Ricci flow in the smooth and non-smooth setting. Joint work with Aaron Naber.