

## Positive Ricci Curvature through Cheeger deformation

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**Abstract.** Let  $(M, g)$  be a Riemannian manifold with an isometric  $G$ -action. If a principal orbit has finite fundamental group and  $\text{Ricci}_{M^{\text{reg}}/G} \geq 1$ , Searle–Wilhelm proved that  $M$  admits a new metric  $\tilde{g}$  of positive Ricci curvature.  $\tilde{g}$  is obtained after a conformal change followed by a Cheeger deformation. The question remained on whether it is sufficient to consider only the Cheeger deformation to attain positive Ricci curvature on the new metric  $\tilde{g}$ . Here we approach this question by giving necessary and sufficient conditions on the  $G$ -action. In particular, we construct an infinite family of manifolds satisfying the hypothesis of Searle–Wilhelm that do not develop positive Ricci curvature after Cheeger deformation. Moreover, as a byproduct of the theory, we give simpler proofs to Searle–Wilhelm result and to Lawson–Yau theorem on the existence of positive scalar curvature on manifolds with non-abelian symmetry.