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Title: Smoothness of cohomogeneity one metrics and obstructions to nonnegative curvature.

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Abstract: Compact simply connected Riemannian manifolds with an isometric action of a compact Lie group that has an hypersurface orbit (cohomogeneity one manifolds) are classified up to dimension seven. Among the, except for two families, parametrised by an integer, in dimension 7, the ones that admit invariant metrics of nonnegative sectional curvature are classified. We show that nonnegative curvature is obstructed on the manifolds that belong to one of these families. In order to prove it we develop a method, of independent interest, for describing smooth invariant metrics on cohomogeneity one manifolds.