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	authors	• Toni Ikonen • Danka LuÄiÄ‡ • Enrico Pasqualetto	**authors**	• Toni Ikonen • Danka Luvci'c • Enrico Pasqualetto	DUPLICATES	728
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	id	id5717437166302767185	**id**	id-4832658816744216271		
	abstract	We prove that every (geometrically) quasiconformal homeomorphism between metric measure spaces induces an isomorphism between the cotangent modules constructed by Gigli. We obtain this by first showing that every continuous mapping Ï† with bounded outer dilatation induces a pullback map Ï†^* between the cotangent modules of Gigli, and then proving the functorial nature of the resulting pullback operator. Such pullback is consistent with the differential for metric-valued locally Sobolev maps introduced by Gigli-Pasqualetto-Soultanis. Using the consistency between Gigli's and Cheeger's cotangent modules for PI spaces, we prove that quasiconformal homeomorphisms between PI spaces preserve the dimension of Cheeger charts, thereby generalizing earlier work by Heinonen-Koskela-Shanmugalingam-Tyson. Finally, we show that if Ï† is a given homeomorphism with bounded outer dilatation, then Ï†^-1 has bounded outer dilatation if and only if Ï†^* is invertible and Ï†^-1 is Sobolev. In contrast to the setting of Euclidean spaces, Carnot groups, or more generally, Ahlfors regular PI spaces, the Sobolev regularity of Ï†^-1 needs to be assumed separately.	**abstract**	We prove that every (geometrically) quasiconformal homeomorphism between metric measure spaces induces an isomorphism between the cotangent modules constructed by Gigli. We obtain this by first showing that every continuous mapping Ï† with bounded outer dilatation induces a pullback map Ï†â^— between the cotangent modules of Gigli, and then proving the functorial nature of the resulting pullback operator. Such pullback is consistent with the differential for metric-valued locally Sobolev maps introduced by Gigliâ€“Pasqualettoâ€“Soultanis. Using the consistency between Gigliâ€™s and Cheegerâ€™s cotangent modules for PI spaces, we prove that quasiconformal homeomorphisms between PI spaces preserve the dimension of Cheeger charts, thereby generalizing earlier work by Heinonenâ€“Koskelaâ€“Shanmugalingamâ€“Tyson. Finally, we show that if Ï† is a given homeomorphism with bounded outer dilatation, then Ï† â^'1 has bounded outer dilatation if and only if Ï†â^— is invertible and Ï† is Sobolev. In contrast to the setting of Euclidean spaces, Carnot groups, or more generally, Ahlfors regular PI spaces, the Sobolev regularity of Ï† needs to be assumed separately.		
	versions		**versions**			