

# ***Seminar 2023***

**Math**

Amenability, optimal transport and cohomology of  
Banach modules

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Sci. building #254

Using tools from the theory of optimal transport, we establish some new results concerning isometric actions of amenable topological groups. Specifically, consider an amenable topological group  $G$  with no non-trivial homomorphisms to  $\mathbb{R}$ . Then, if  $d$  is a compatible left-invariant metric on  $G$ ,  $E \subseteq G$  is a finite subset and  $\varepsilon > 0$ , there is a finitely supported probability measure  $m$  on  $G$  so that

$$\max_{g \in E} W(m, g, m) < \varepsilon$$

where  $W$  denotes the Wasserstein or optimal transport distance between probability measures on the metric space  $(G, d)$ . When  $d$  is the word metric on a finitely generated group  $G$ , this strengthens a well-known theorem of H. Reiter. Furthermore, when  $G$  is locally compact,  $m$  may be replaced by an appropriate probability density  $f \in L^1(G)$ .

Also, when  $G \curvearrowright X$  is a continuous isometric action on a metric space, the space of Lipschitz functions on the quotient  $X // G$  is isometrically isomorphic to a 1-complemented subspace of the Lipschitz functions on  $X$ . And finally every continuous affine isometric action of  $G$  on a Banach space has a canonical invariant linear subspace.

These results generalize previous theorems due to Schneider-Thom and Cúth-Doucha.



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