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Faithful actions of automorphisms on the space of orderings of a group

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We study the space of left- and bi-invariant orderings on a torsion-free nilpotent group G . We will show that generally the set of such orderings is equipped with a faithful action of the automorphism group of G . We prove an extension result which allows us to establish the same result when G is assumed to be merely residually torsion-free nilpotent. In particular, we obtain faithful actions of mapping class groups of surfaces. We will draw connections between the structure of orderings on residually torsion-free nilpotent, hyperbolic groups and their Gromov boundaries, and we show that in those cases a faithful $\text{Aut}(G)$ -action on the boundary is equivalent to a faithful $\text{Aut}(G)$ action on the space of left-invariant orderings.

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