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Balanced finite presentations of the trivial group and geometry of four-dimensional manifolds

Recently Boris Lishak has constructed a sequence of finite presentations of the trivial group with just two generators and two relations such that the minimal number of applications of relations required to demonstrate that a generator is trivial grows faster than the tower of exponentials of any fixed height of the length of the finite presentation.

I will explain this result and some of its implications to Riemannian geometry of four-dimensional manifolds. For example, for each closed four-dimensional Riemannian manifold M and each sufficiently small positive ϵ the set of isometry classes of Riemannian metrics on M of volume one with the injectivity radius greater than ϵ is disconnected. A similar disconnectedness result holds for sets of Riemannian structures with $\sup |K| diam^2 \leq x$ on each closed four-dimensional manifold with non-zero Euler characteristic providing that x is sufficiently large. (A joint work with Boris Lishak.)