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Topological rigidity of aspherical manifolds

Abstract: The Borel Conjecture predicts for two closed aspherical manifolds that any homotopy equivalence between them is homotopic to a homeomorphism. In particular they are homeomorphic if and only if their fundamental groups are isomorphic. This may be viewed as the topological version of Mostow rigidity. This conjecture is related via surgery theory to the Farrell-Jones Conjecture about the algebraic K-and L-theory of group rings, and to the classical Novikov Conjecture about the homotopy invariance of higher signatures.

We will report on the significance and relations between these conjectures and on a recent result together with Arthur Bartels. It says that the class of groups for which these conjectures hold contains hyperbolic groups and CAT(0)-groups and is closed under certain operations such as taking subgroups, finite products and directed colimits. This shows that prominent groups such as limit groups, certain exotic groups arising as directed colimits of hyperbolic groups and certain exotic closed aspherical manifolds arising from hyperbolization techniques do satisfy all these conjectures. The main technical input in the proofs are controlled topology, methods from algebraic K-and L-theory, surgery theory and the construction of flow spaces which mimic the geodesic flow on the sphere bundle of the universal covering of a closed Riemannian manifold.