

Classification of Manifolds and Homotopy Theory

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A classical problem in differential topology is the following: classify up to diffeomorphism all simply-connected smooth closed oriented $2n$ -manifolds whose only nonzero homology groups are H_0 , H_n , and H_{2n} . In this talk, I will discuss the solution of this problem, from the seminal work of Wall to its final resolution by the speaker and his collaborators. Our solution makes heavy use of the tools of modern homotopy theory and especially the Adams spectral sequence.

Time permitting, I will then sketch how these results may be extended into the metastable range, where the nonzero homology of the manifold is assumed to lie in H_0 , H_{n-e} , \dots , H_{n+e} , and H_{2n} for e small relative to n . (We also obtain results for odd-dimensional manifolds.) This extension makes use of a mix of surgery theory and homotopy theory.

This is joint work with Robert Burklund and Jeremy Hahn.