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Abstract:

Algebraic invariants have always been one of topologists' main tools for studying smooth manifolds. For example, diffeomorphism classes of closed, oriented, connected 2-dimensional manifolds are distinguished by a single number: the Euler characteristic.

Alas, 3-dimensional manifolds are far more complex, and such a simple invariant can no longer say much that is meaningful. I will describe a powerful invariant of 3-manifolds which can: Heegaard Floer homology, introduced a few years ago by Ozsvath and Szabo, has had remarkable success in addressing long-standing questions. The additional data of a link in the 3-manifold yields a refinement of the invariant, useful because all 3-manifolds are obtainable by performing surgery on links in the 3-sphere. I will explain what all of these things mean, and discuss a possible program for obtaining yet stronger invariants by using a natural twisted coefficient system arising from a classical algebraic invariant: the fundamental group.