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Heegaard Floer Homology and its Applications

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This is basically a construction of Ozsvath and Szabo which assigns to a Heegaard diagram (that is a surface of genus g with two sets (a_1, \dots, a_g) and (b_1, \dots, b_g) of linearly independent simple closed curves on the surface, and a number of marked points in the complement of the curves) a homology theory through the general construction of Lagrangian Floer homology. It assigns homology groups to three-manifolds and homomorphisms to 4-manifold cobordisms. I'll describe some of the applications and then will talk mostly about a version that assigns homology groups to knots and links in three-manifolds. they generalize the Alexander polynomial in the sense that the Euler characteristic of the homology groups gives the Alexander polynomial. The most interesting applications appear in this context. These groups distinguish the genus of a knot and the Thurston norm of a link in general. I can talk on this subject in one or two lectures, depending on how much interested you think the audience is going to be.