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Title: Beyond the Alexander polynomial

The simplest invariant of a 3-dimensional rational homology sphere (RHS) is the order of its first homology. A much more advanced invariant of a RHS is the Casson-Walker invariant. It measures the Euler characteristic of the moduli space of flat SU(2) connections on that manifold. It has been learned in recent years, that both of these invariants are just the first elements of an infinite sequence of RHS invariants of growing complexity -- the so-called finite type invariants.

There is a similarity between RHS and infinite cyclic covers of knot complements in S^3. In particular, their first homology groups are pure torsions if the latter is considered as a module over Z[t]. In the framework of this similarity, the Alexander polynomial of a knot is the analog of the order of first homology of RHS. We will show how to apply this similarity to other finite type invariants of RHS. Their knot counterparts turn out to be multi-variable polynomial invariants of knots which satisfy appropriate finite-type properties. In particular, the analog of the Casson-Walker invariant is a 2-variable polynomial with certain symmetry properties.