

KNOT CONCORDANCE, WHITNEY TOWERS AND L^2 -SIGNATURES

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We construct many examples of non-slice knots in 3-space that cannot be distinguished from slice knots by previously known invariants. Using Whitney towers in place of embedded disks, we define a geometric filtration of the 3-dimensional topological knot concordance group. As special cases of Whitney towers of height less than four, the bottom part of the filtration exhibits all classical concordance invariants, including the Casson-Gordon invariants. Considering our entire filtration could lead to a 4-dimensional homology surgery theory. As a first step, we construct an infinite sequence of new obstructions that vanish on slice knots. These take values in the L-theory of skew fields associated to certain rationally universal solvable groups. Finally, we use the dimension theory of von Neumann algebras to detect the first unknown step in our obstruction theory by an L^2 -signature, providing infinitely many examples of non-slice knots with vanishing Casson-Gordon invariants.

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