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Periodicity in Stable Equivariant Surgery. Preliminary report.

The classical surgery theory computes the structure set $S_m(M, \mathrm{rel}\,\partial)$ of manifolds homotopy equivalent to M relative to the boundary. Siebenmann showed that the structure set is 4-periodic: $S_m(M, \mathrm{rel}\,\partial) = S_{m+4}(M \times D^4, \mathrm{rel}\,\partial)$, for topological manifolds. We use Weinberger's stratified surgery theory to entend the periodicity to topological manifolds with homotopically stratified actions by compact Lie groups, with the 4-disc replaced by various group representations. (Received July 29, 1991)

868-57-156 ROBION KIRBY, University of California, Berkeley, CA 94720,
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Quantum invariants of lens spaces and a Dehn surgery formula. Preliminary report.

We give formulas for quantum invariants of lens spaces $L(c,a)$ in terms of Dedekind sums $s(a,c)$ and the Rademacher φ function (defined by $\varphi\binom{a\ b}{c\ d} = 12s(a,c) - (a+d)/c$ for positive a and c), and discuss a general formula for the invariants of 3-manifolds obtained by Dehn surgery on a link.

Quantum invariants were introduced in 1988 by Witten using Chern-Simons gauge theory, and subsequently formulated by Reshetikhin and Turaev in terms of quantum groups. Work has focused on the invariants derived from the quantum groups U_t associated to sl(2,C) at a primitive 4rth root of unity t (with values in the cyclotomic field $Q(t)$). We assume $t = \exp(2\pi i/4r)$ (the invariants at other 4rth roots are simply transformed by $\mathrm{Gal}(Q(t)/Q)$) and write τ_r for the corresponding invariant as normalized in [KM] (Kirby-Melvin, *The 3-manifold invariants of Witten and Reshetikhin-Turaev for* sl(2,C), Inv. Math. 1991). It is shown in [KM] that for r odd, τ_r splits as a product of τ_3 (or its conjugate) and an invariant τ_r'. A simple general formula is given for τ_3.

Here we compute $\tau_r' = \tau_r'(L(c,a))$ for prime r: If r does not divide c, then $\tau_r' = (\frac{c}{r})[(1/c)_r]t^{12s(a,c)_r}$ (where $(-)$ is the Legendre symbol and $(x/y)_r$ denotes $x\bar{y}$ for any odd inverse $\bar{y}$ of y (mod r)). If r divides c, then $\tau_r' = 0$ unless $a \equiv \pm 1$ (mod r), in which case $\tau_r' = \varepsilon\sqrt{r}\,t^{12\varphi(A)+ab}/(t^2 - \bar{t}^2)$. Here $A = \binom{a\ b}{c\ d}$ is in $SL(2,Z)$ and ε is a power of i depending only on a and r (mod 4). One striking consequence of these formulas is the fact that the invariants τ_r (for prime r) do not distinguish all lens spaces. For example $L(65,8)$ and $L(65,18)$ have the same prime invariants.

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*868-57-157 Frank Connolly, University of Notre Dame, Notre Dame IN, 46556. and Tadeusz Kozniewski, University of Warsaw, Warsaw, Poland. *On the UNil group of Cappell.*

We study the group $UNil^h_{2n}(R; B_1, B_{-1})$, where $(R; B_1, B_{-1})$ is a ring and two bimodules with involution, as defined by Cappell (B.A.M.S. v.80 (1974) p.1117-1122). One writes $UNil^h_{2n}(R)$ for $UNil^h_{2n}(R; R, R)$.

1. The geometrically significant case occurs when H, G_1, G_{-1} are finitely presented groups with orientation characters, and $G_i \supset H$, $R = Z[H]$, $B_i = Z[G_i - H]$. In this case we prove that: $UNil^h_{2n}(R; B_1, B_{-1}) = L_\epsilon(\mathbb{A}_\alpha[t])$, $\epsilon = (-1)^n$. Here $L_\epsilon(\ )$ denotes Ranicki's L-group of an additive category, $\mathbb{A}$ and α denote the "additive category and functor defined by $(R; B_1, B_{-1})$" and $\mathbb{A}_\alpha[t]$ denotes its twisted polynomial extension category (a twisted version of Ranicki's notion).

2. Using 1., we construct a monoid of natural endomorphisms $\{F_1, F_3, F_5, \ldots\}$ of $UNil^h_{2n}(R)$, for any ring with involution R. It satisfies (i)$F_a F_b = F_{ab}$, and (ii)For any $x \in UNil^h_{2n}(R)$, $\{a | F_a(x) \neq 0\}$ is finite.

3. When $K = R/2R$ is a product of perfect fields, with trivial involutions, we construct a kind of "Arf invariant", $A : UNil^h_2(R) \to K[t]/(\psi_2 - 1)K[t]$, where ψ_2 denotes the Frobenius map. If, in addition, R is a Dedekind domain, with trivial involution, this fits into a short exact sequence:

$$0 \to UNil^h_2(R) \to K[t]/(\psi_2 - 1)K[t] \to K/(\psi_2 - 1)K \to 0$$

4. We then compute $UNil^h_{2n}(R)$ for any Dedekind domain with involution in which 2 does not ramify, and for any simple algebra of finite dimension over the prime fields. (Received July 30, 1991)