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Knot state asymptotics II, Witten conjecture and irreducible representations

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This article pursues the study of the knot state asymptotics in the large level limit initiated in "Knot sate Asymptotics I". As a main result, we prove the Witten asymptotic expansion conjecture for the Dehn fillings of the figure eight knot. The state of a knot is defined in the realm of Chern-Simons topological quantum field theory as a holomorphic section on the SU(2)-character manifold of the peripheral torus. In the previous paper, we conjectured that the knot state concentrates on the character variety of the knot with a given asymptotic behavior on the neighborhood of the abelian representations. In the present paper we study the neighborhood of irreducible representations. We conjecture that the knot state is Lagrangian with a phase and a symbol given respectively by the Chern-Simons and Reidemeister torsion invariants. We show that under some mild assumptions, these conjectures imply the Witten conjecture on the asymptotic expansion of WRT invariants of the Dehn fillings of the knot. Using microlocal techniques, we show that the figure eight knot state satisfies our conjecture starting from q-differential relations verified by the colored Jones polynomials. The proof relies on a differential equation satisfied by the Reidemeister torsion along the branches of the character variety, a phenomenon which has not been observed previously as far as we know.

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