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Stratification and Quantization of Chern-Simons Phase Space: Towards Witten's Asymptotic Conjecture

In three-dimensional topological quantum field theory, the Witten-Reshetikhin-Turaev (WRT) invariants are famously formulated via the path integral of Chern-Simons gauge theory. The rigorous geometric quantization of the underlying classical phase space—the moduli space of flat $\mathrm{SU}(2)$ connections on a Riemann surface—provides a powerful mathematical framework for understanding these physical invariants. However, traditional geometric approaches, such as those relying on the Jeffrey-Weitsman-Witten (JWW) invariants, have historically faced limitations due to the presence of singular strata corresponding to reducible connections.

This talk presents a stratified quantization recipe for the half density, or half-form bundle, over the moduli space which incorporates these singular strata independently into the defining integral. By isolating the treatment of the singularities we more closely harmonize the geometrically derived invariants with the expected WRT invariants from QFT.