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Wilson operator algebras and ground states for coupled BF theories APOORV TIWARI, University of Illinois at Urbana Champaign, XIAO CHEN, Kavli Institute for theoretical physics at Santa Barbara, SHINSEI RYU, University of Illinois at Urbana Champaign — The multi-flavor BF theories in (3+1) dimensions with cubic or quartic coupling are the simplest topological quantum field theories that can describe fractional braiding statistics between loop-like topological excitations (three-loop or four-loop braiding statistics). In this paper, by canonically quantizing these theories, we study the algebra of Wilson loop and Wilson surface operators, and multiplets of ground states on three torus. In particular, by quantizing these coupled BF theories on the three-torus, we explicitly calculate the $\mathcal{S}$- and $\mathcal{T}$-matrices, which encode fractional braiding statistics and topological spin of loop-like excitations, respectively. In the coupled BF theories with cubic and quartic coupling, the Hopf link and Borromean ring of loop excitations, together with point-like excitations, form composite particles.

Apoorv Tiwari
University of Illinois at Urbana Champaign

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