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## Chern–Simons theory on $S^3/G$ and topological strings

*Thursday, 30 June 2016 17:00 (25 minutes)*

We study the matrix models representing (a piece of)  $SU(N)$  Chern-Simons partition function on quotients of  $S^3$  by a finite group of isometries (these are the spherical Seifert manifolds). We show 1) that these partition functions have  $1/N$  asymptotic (by opposition to formal) expansion, which is computed by the topological recursion of Eynard and Orantin for a suitable spectral curve and 2) that the spectral curve is algebraic and can be constructed in relation with ADE root systems (E8 being realized by the Poincaré sphere). We also show by explicit (and complete for all cases except E8) checks that this spectral curve is a specialization of the spectral curve of a relativistic ADE Toda chain considered by Marshakov et al. and Williams. Relying on large  $N$  transitions, geometric engineering and correspondences between gauge theories and integrable systems, this fits into a generalization of the Gopakumar-Vafa conjecture to  $S^3/G$ . E.g., a correspondence between its CS invariants and the Gromov-Witten invariants of a Calabi-Yau 3 fold  $X_{\{G\}}$ , with the interesting feature that  $X_{\{G\}}$  is non-toric when  $G$  is not abelian.

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