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Partiton Function of U(N) 5D Gauge Theory with Hyper-multiplets via 2D Topological Field Theory Amplitudes

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Engineering of supersymmetric(SUSY) gauge theories in string theories is a powerful tool to study the SUSY gauge theories and has lead to many fascinating dualities. It has been recently found that SUSY indices of certain SUSY gauge theories are related to two dimensional topological field theories (TFTs). For example, U(1) gauge theory with g-adjoint hyper-multiplets can be engineered using Calabi-Yau Three-folds (CY3s) that are C^2 bundles over genus-g surfaces. Vafa et.al. and Pandharipande et. al. have shown that the partition function of the topological string theory on these CY3s can be obtained via partition functions of certain 2-d TFT which is just the q-deformed Yang-Mills theory. The partition function of the gauge theory itself can be built from amplitudes of the 2d TFT which are just the open string amplitudes of the corresponding CY3.

We generalize this result to U(N) gauge theory with g-adjoint hyper-multiplets via geometric engineering on a Calabi-Yau three-fold that is A_N (resolution of singularity) fibration on genus-g curve by relating the open string theory amplitudes on this Calabi-Yau with the amplitudes of 2-d TFT which in this case is just quiver q-deformed gauge theory.

Note: This talk is built upon the work that is published in JHEP 1512 (2015) 017.

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