

Gopakumar, Rajesh; Vafa, Cumrun

On the gauge theory. Geometry correspondence. (English) [Zbl 1026.81029](#)

Vafa, Cumrun (ed.) et al., Winter school on mirror symmetry, vector bundles and Lagrangian submanifolds. Proceedings of the winter school on mirror symmetry, Cambridge, MA, USA, January 1999. Providence, RI: American Mathematical Society (AMS). AMS/IP Stud. Adv. Math. 23, 45-63 (2001).

The authors propose a new duality: they show that the large N limit of $SU(N)$ Chern-Simons theory on the 3-sphere S^3 is exactly the same as an $N = 2$ topological closed string theory blow up of the conifold geometry. The $SU(N)$ Chern-Simons theory on S^3 arises from the A-model open string theory on the Calabi-Yau manifold T^*S^3 with Dirichlet boundary conditions on S^3 . The authors compare the partition functions of the Chern-Simons and the closed string theories and find a strikingly exact match for all values of the 't Hooft coupling constant λ and to all orders of $1/N$. They discuss a possibility to derive the duality from the 2-d linear sigma model, considered by E. Witten, that is an $N = 2$ supersymmetric $U(1)$ gauge theory, whose low energy dynamics description reduces to the usual nonlinear sigma model on the S^2 blown up version of the conifold. The authors believe that the linear sigma model approach can be also useful in deriving the AdS/CFT correspondence.

For the entire collection see [\[Zbl 0980.00027\]](#).

Reviewer: [Dimitrii V. Alekseevsky \(Hull\)](#)

MSC:

- [81T10](#) Model quantum field theories
- [81T30](#) String and superstring theories; other extended objects (e.g., branes) in quantum field theory
- [81T13](#) Yang-Mills and other gauge theories in quantum field theory
- [83E30](#) String and superstring theories in gravitational theory
- [83C47](#) Methods of quantum field theory in general relativity and gravitational theory

Cited in 1 Review
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Keywords:

[gauge theory](#); [Chern-Simons theory](#); [topological string theory](#); [AdS/CFT correspondence](#)