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The moduli space of vacua for the topological $\mathcal{N} = 2$ supersymmetric pure gauge theories with gauge group $SU(2)$ or $SO(3)$ is the universal elliptic curve for the modular group $\Gamma(2) \subset SL(2; \mathbb{Z})$. Moreover, the supersymmetric gauge theory associates a not necessarily holomorphic modular form of weight $(\frac{1}{2} b_2^+ + 1, \frac{1}{2} b_2^-)$ to each four-manifold.

In the case $b_2^+ = 1$ the contributions of this function at the cusps of $\mathbb{H}/\Gamma(2)$ are interesting (almost) topological invariants of the manifold. To evaluate the cusp contributions, also called the u -plane integral, one can use nonholomorphic modular forms or Mock theta functions. In the case of the $SO(3)$ -gauge theory on $\mathbb{C}P^2$ we prove using a particular Mock theta function that the cusp contribution from $\tau = i\infty$ is closely related to the Donaldson invariants of $\mathbb{C}P^2$, a conjecture made by Moore and Witten. (Received September 14, 2010)