



# Instanton effective action in $\Omega$ -background and D3/D(-1)-brane system in R-R background

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# Theme of the work

Study  $\Omega$ -background in  $\mathcal{N} = 2$  SYM via string theory

- What is  $\Omega$ -background ?

In Nekrasov's calculation of instanton partition function, some deformations of the  $\mathcal{N} = 2$  SYM is considered.

- Introduce noncommutative parameters
    - Resolve the singularity of the instanton moduli space
  - Introduce  $\Omega$ -background (graviphoton background)
    - Isolated fixed pts for deformed SUSY operator on the instanton moduli space
- We can perform the integral of instanton moduli action on the instanton moduli space using the localization formula.
- Obtain instanton partition function

Want to apply the methods of instanton calculus to many other theories.

→ Interpret in terms of **String theory**

- High dimensional instantons
  - D6/D0 system [Jafferis]
  - D7/D(-1) system [Billo-Ferro-Frau-Gallot-Lerda-Pesando]
- Instantons in quiver type gauge theory
- Field theories with more or less SUSY
- ...

The  **$\Omega$ -background** deformations are described by **closed string backgrounds**.

**Computing the partition function of topological closed string**

→ The higher-genus correction of the partition function corresponds to the **self-dual graviphoton background**.

[Antoniadis-Gava-Narain-Taylor]

**D3/D(-1)-branes and self-dual RR 3-form flux** (orbifolded spacetime)

→  $\mathcal{N} = 2$  **Instanton moduli action** deformed by **self-dual  $\Omega$ -background**

[Billo-Frau-Fucito-Lerda]

... **Self-dual part of the background** has been well studied.

Recently there are many works on non-self-dual  $\Omega$ -background.

Topological closed string with non-self-dual graviphoton background

→ “Refinement” of the topological string

[Iqbal-Kozcaz-Vafa , Taki , ...]

Non-self-dual  $\Omega$ -background deformation of  $\mathcal{N} = 2$  SYM

→ Related with some integrable systems

[Nekrasov-Shatashvili , Mironov-Morozov , ...]

What corresponds to general (non-self-dual)  $\Omega$ -background deformation at the level of instanton moduli action ?

- Main result of our work

Instanton moduli action  
of  $\mathcal{N} = 2$  SYM  
deformed by  
general  $\Omega$ -background



Deformed ADHM construction

=

D(-1)-brane effective action  
of D3-D(-1) system in orbifolded spacetime  
deformed by  
Some type of R-R 3-form



Computation of string amplitudes connecting  
R-R and D(-1)

In order to keep SUSY, we have to introduce R-sym. Wilson line.

... Also reproduced in string theory considering other type of R-R 3-form