

## Research Report (April, 2018 - March, 2019)

Enrollment from  
April 2017

Department of Pure Mathematics and Applied  
Mathematics

Yoshiki Kaneko

### I. List of Papers

### II. List of Talks

1. Yoshiki Kaneko "Solutions of the  $tt^*$ -Toda Equations Corresponding to Quantum Cohomology of Flag Manifolds" UK-Japan Winter School 2019, Leeds University, 2019/1/7-1/10, poster session
2. Yoshiki Kaneko "Local Solutions of the  $tt^*$ -Toda Equations from Flag Manifolds" Waseda Wakate Ibunya, Waseda University, 2019/3/22.

### III. Research Results in AY2018

Cecotti and Vafa expected that quantum cohomologies of some manifolds correspond to solutions of the  $tt^*$ -Toda equations. M. Guest and some other researchers found that in the case of  $SU(4)$ ,  $SU(5)$ ,  $SU(6)$ , solutions are obtained from the Dubrovin connections by considering the quantum product of projective spaces. On another research, M. Guest and N. Ho extended the definition of the  $tt^*$ -Toda equations for the case of general complex simple Lie groups. In my research I found that when simple Lie groups are  $SU(n+1)$ ,  $SO(2n+1)$ ,  $Sp(n)$ ,  $SO(2n)$ , we obtain solutions of the  $tt^*$ -Toda equations from  $CP^n$ ,  $Q_{2n-1}$ ,  $CP^{2n-1}$ ,  $Q_{2n-2}$  respectively.

### IV. Research Plan for AY2019

I have three plans of my research. Firstly I will show the general case of above results. The above manifolds correspond to the origin of fundamental Weyl alcove of each classical simple Lie groups. My first plan is that I will find manifolds which correspond to the origin of general simple Lie groups. Then it is known that other points in FWA which correspond to the quantum cohomology. These points are the Integer Stokes data whose conditions are that the Stokes data are integer. M. Guest and other researchers found that some weighted projective spaces correspond to these points in the cases of  $SU(4)$ ,  $SU(5)$ ,  $SU(6)$ . Thus the second my research plan is that I will found that some weighted objects of above manifolds which correspond to solutions in classical Lie group cases. I hope that this try will be generated for general complex simple Lie groups. Finally it is known that the condition of the Integer Stokes data is equivalent to the condition that the fundamental representations of Lie groups become integer. From this fact we can expect that there are some relationships from the viewpoint of representation theory. I would like to be clear this relationship.