様式 ２　帰国報告書 (ITP Research Report)

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Research Report of JSPS-ITP
(The international sending-elevating project for young mathematicians
based on singularity, topology and mathematical analysis: Hokudai model)

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Research Report:

First of all, I would like to express my sincere gratitude to the ITP program, Department of Mathematics of Hokkaido University, Professor Yves Laurent and everyone concerned. Thanks to their support, I visited Institut Fourier for a year from September 2010 to August 2011. Here, I would like to report on my activity during the stay in Grenoble. My activity consists of two parts. Firstly, from October to November 2010, Prof. Yves Laurent organized the seminar “Gropes des travail GT Analysis WKB et D-modules” at Institut Fourier. Thanks to Prof.Y.Laurent, I was able to talk about the results [1], [2], [3] which I had obtained before the stay. Especially, fortunately for me, I had opportunities to discuss with Prof.Y.Laurent, Prof.B.Malgrange and Prof.S.Guillermou in the seminars and they gave me many valuable advices. It is very happy for me that I was able to have unforgettable valuable opportunities. My research interest is the exact WKB analysis. Before the stay, I was studying on the construction of instanton-type solutions, which play an important role in the description of the connection problems of WKB solutions, form a view point of the multiple-scale analysis with Prof. N.Honda and Prof.T.Aoki. In the paper [3], I have proved that we can construct the instanton-type solutions for the first Painleve hierarchy. However, it is not discussed yet whether we are able to apply our method to other higher order Painleve equations. After the seminar, I started the research to establish the way of the construction of instanton-type solutions for higher order Painleve equations .To apply the method of [3] to the other Painleve hierarchies, I improved the method of [3] by using the generating functions of unknown functions for the first Painleve hierarchy in the paper [4]. In addition, generally, for a differential equation with a large parameter of 2m-unknown functions, which satisfies a condition:“the characteristic equation of the Frechet derivative of the equation at the leading term of the 0-parameter solution is an even function”, I gave a method to construct an instanton-type solutions by the multiple-scale analysis. On February, I had a very nice

opportunity to discuss with Prof. N.Honda at Grenoble. Thanks to the discussions, we proved some important results in [4]. In March, I proved that we can construct the instanton-type solutions for the second Painleve hierarchy and the result is given in [5]. On April, I presented these results in the conference “GF2011 International Conference on Generalized Functions” which was held at Universite des Antilles et de la Guyana in Martinique. Thanks to the support of ITP program and the GF2011 organizing committee, I was able to participate in the conference. It was very nice opportunity for me to talk with many participants from more than 20 countries and I learned a lot from many interesting their talks.

Next, I would like to describe the second part of my activity. I am particularly interested in Prof.Y.Laurent’s papers. The most important aim of my stay was to study D-modules under Prof.Y.Laurent. From November to January 2011, Prof.Y.Laurent gave me the very valuable lectures every week. I am deeply grateful to Prof.Y.Laurent for giving me the many lectures. As Prof.Y.Laurent’s advice, I am reading some books and some papers. Especially, I was able to learn a lot form the paper ‘’Pentes algebriques et pentes analytiques d’un D-module”. I am going to continue studying these problems. I trust this valuable experience promote my study in the future. Thanks to the support of ITP program and organizers, I was able to participate in “School on D-modules and applications in Singularity Theory” which was held in Universidad de Sevilla (June 20-25, 2011) and the Mathematical Science Institute of ICMAT (June 27 to July 2, 2011).

I am deeply grateful to ITP program and the Department of Mathematics of Hokkaido Univ. for giving me the opportunity to study in abroad. I would like to express my sincere gratitude to ITP program again and I would like to thank many people who helped me in various way.

Reference

[1] On the number of the turning points of the second kind of the Noumi-Yamada systems with a large parameter (with T.Aoki and N.Honda), to appear in RIMS Bessatsu.
[2] On the solid or dotted line conditions for the degenerate Stokes geometry (with N.Honda), in preparation.
[3] On the exact WKB analysis for Painleve hierarchies with a large parameter, the doctoral thesis, Hokkaido Univ. (2010)
[4] On a construction of instanton-type solutions for the first Painleve hierarchy from a view point of the multiple-scale analysis (with T.Aoki and N.Honda), in preprint
[5] On a construction of instanton-type solutions for the second Painleve hierarchy, in preprint