Research Report（April, 2021- March, 2022）

Enrollment from April 2020 | Department of Pure and Applied Mathematics | Tadashi Udagawa

I. List of Papers

II. List of Talks

[1] Tadashi Udagawa, ''Filtered bundles and moduli of Higgs bundles'', Koriyama Geometry and Physics Days 2021, Nihon University (Koriyama Campus), 14 Nov. 2021.

[2] Tadashi Udagawa, ''Globality of the DPW construction for Smyth potentials in the case of SU(1,1)'', The 13th MSJ-SI 2020 Mathematical Society of Japan -Seasonal Institute (Differential Geometry and Integrable Systems – Mathematics of Symmetry, Stability and Moduli-), Osaka City University (Sugimoto Campus) and Online (Zoom), 4 March 2022.

III. Research Results in AY2020

First, I constructed constant mean curvature surfaces (CMC surfaces) in the Minkowski space by using the DPW method in the case of Smyth potential. In terms of the DPW method, the global solutions of the Gauss-Codazzi equation corresponds to the global Iwasawa factorization for loop group. Since the corresponding Gauss-Codazzi equation can be regarded as the sinh-Gordon equation, we obtain the global solution of the sinh-Gordon equation from the global Iwasawa factorization. I proved that we obtain the global Iwasawa factorization by using the asymptotic expansion of the Bessel functions and the results of the Riemann-Hilbert problem. Second, I proved that the conformal limit of the Higgs bundle with Smyth-type Higgs filed is an oper, which is a special case of flat bundle. In terms of Physics, this is called the Gaiotto's conjecture and it is important in conformal field theory.

IV. Research Plan for AY2021

For Smyth potentials, the corresponding scalar equation is the Bessel equation, thus we can use the asymptotic expansion of the Bessel functions to investigate the globality of the Iwasawa factorization. More generally, I will try to investigate the globality of the Iwasawa factorization which corresponds to the special functions by using the similar method. Next, we will extend the proof of the Gaiotto's conjecture for Smyth potentials to the holomorphic potentials which have regular singularities at infinity. In this case, I guess that the corresponding harmonic metric is conformally equivalent to the solution of the sinh-Gordon equation.