Research Report（April, 2023- March, 2024）

Enrollment from April 2023   Department of Pure and Applied Physics   Ryunosuke KUSABA

I. List of Papers

1. R. Kusaba, T. Ozawa, *Weighted estimates and large time behavior of small amplitude solutions to the semilinear heat equation*, Differ. Equ. Appl., 15 (2023), no. 3, 235-268.

2. R. Kusaba, T. Ozawa, *Asymptotic behavior of global solutions to the complex Ginzburg-Landau type equation in the super Fujita-critical case*, submitted. [arXiv:2401.06363]

II. List of Talks

1. 優藤田冪を持つ非線形熱方程式に対する時間大域解の高次漸近展開, The 44th Young Researchers Seminar on Evolution Equations, Kyoto University of Education, Sep. 3, 2023.

2. Commutator estimates between the heat semigroup and monomial weights and its application, MSJ Automn Meeting 2023, Tohoku University, Sep. 21, 2023.

3. Asymptotic behavior of global solutions to the complex Ginzburg-Landau type equation in the super Fujita-critical case, 数学・数理科学専攻若手研究者のための異分野・異業種研究交流会 2023, Chuo University, Oct. 14, 2023.

4. Higher order asymptotics for the complex Ginzburg-Landau type equation in the super Fujita-critical case, The 49th Evolution Equations and Applications, Tokyo University of Science, Dec. 25, 2023.

5. Asymptotic expansions for the complex Ginzburg-Landau type equation in the super Fujita-critical case, The 20th Mathematics Conference for Young Researchers, Hokkaido University, Mar. 5, 2024.

6. Higher order asymptotic expansions for the complex Ginzburg-Landau type equation in the supercritical case, MSJ Spring Meeting 2024, Osaka Metropolitan University, Mar. 18, 2024.

III. Research Results in AY2023

I studied the large time behavior of global solutions to the complex Ginzburg-Landau (CGL) type equation. We established higher order asymptotic expansions of the global solutions in the super Fujita-critical case. Moreover, we partially showed that the decay rate of the remainder is optimal and the optimality is characterized by the moments of the initial data and the nonlinear term. We also established commutator estimates between the CGL semigroup and monomial weights to derive weighted estimates of the global solutions. This approach enables us to derive the weighted estimates without using the comparison principle and some compactness arguments. We obtained the same results for the convection-diffusion equation.

IV. Research Plan for AY2024

For the complex Ginzburg-Landau type equation and the convection-diffusion equation, I will solve the open problem which I could not complete last year on the optimality of the decay rates of the remainders for the higher order asymptotic expansions. I will establish weighted estimates and higher order asymptotic expansions for the nonlinear damped wave equation.