## FINAL STATE PROBLEM FOR THE NONLOCAL NONLINEAR SCHRÖDINGER EQUATION WITH DISSIPATIVE NONLINEARITY

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*Abstract.* We consider the asymptotic behavior of solutions to the nonlocal nonlinear Schrödinger equation with dissipative nonlinearity. We prove that there exists a solution which has different behavior from that of the typical cubic nonlinear Schrödinger equation.

Mathematics subject classification (2010): 35Q55.

*Keywords and phrases*: Nonlinear Schrödinger equation, asymptotic behavior, critical nonlinearity, dissipative nonlinearity.

## REFERENCES

- M. J. ABLOWITZ AND Z. H. MUSSLIMANI, Integrable nonlocal nonlinear Schrödinger equation, Phys. Rev. Lett. 110 (2013), no. 6–8.
- [2] P. DEIFT AND X. ZHOU, Long-time asymptotics for solutions of the NLS equation with initial data in a weighted Sobolev space, Comm. Pure Appl. Math. 56 (2003), no. 8, 1029–1077.
- [3] N. HAYASHI, C. LI, AND P. I. NAUMKIN, On a system of nonlinear Schrödinger equations in 2D, Differential Integral Equations 24 (2011), no. 5-6, 417–434.
- [4] N. HAYASHI, C. LI, AND P. I. NAUMKIN, Modified wave operator for a system of nonlinear Schrödinger equations in 2d, Comm. Partial Differential Equations 37 (2012), no. 6, 947–968.
- [5] N. HAYASHI AND P. I. NAUMKIN, Asymptotics for large time of solutions to the nonlinear Schrödinger and Hartree equations, Amer. J. Math. 120 (1998), no. 2, 369–389.
- [6] N. HAYASHI AND P. I. NAUMKIN, Domain and range of the modified wave operator for Schrödinger equations with a critical nonlinearity, Comm. Math. Phys. 267 (2006), no. 2, 477–492.
- [7] N. HAYASHI, P. I. NAUMKIN, A. SHIMOMURA, AND S. TONEGAWA, Modified wave operators for nonlinear Schrödinger equations in one and two dimensions, Electron. J. Differential Equations 2004, No. 62, 16 pp.
- [8] N. HAYASHI, P. I. NAUMKIN, AND H. SUNAGAWA, On the Schrödinger equation with dissipative nonlinearities of derivative type, SIAM J. Math. Anal. 40 (2008), no. 1, 278–291.
- [9] N. HAYASHI, H. WANG, AND P. I. NAUMKIN, Modified wave operators for nonlinear Schrödinger equations in lower order Sobolev spaces, J. Hyperbolic Differ. Equ. 8 (2011), no. 4, 759–775.
- [10] J. IEDA, T. MIYAKAWA, AND M. WADATI, *Matter-Wave Solitons in an F* = 1 *Spinor Bose-Einstein Condensate*, J. Phys. Soc. Jpn. **73** (2004), 2996–3007.
- [11] M. IFRIM AND D. TATARU, Global bounds for the cubic nonlinear Schrödinger equation (NLS) in one space dimension, Nonlinearity 28 (2015), no. 8, 2661–2675.
- [12] J. KATO AND F. PUSATERI, A new proof of long-range scattering for critical nonlinear Schrödinger equations, Differential Integral Equations 24 (2011), no. 9-10, 923–940.
- [13] Y. NAKAMURA, A. SHIMOMURA, AND S. TONEGAWA, Global existence and asymptotic behavior of solutions to some nonlinear systems of Schrödinger equations, J. Math. Sci. Univ. Tokyo 22 (2015), no. 3, 771–792.
- [14] T. OGAWA AND K. URIYA, Final state problem for a quadratic nonlinear Schrödinger system in two space dimensions with mass resonance, J. Differ. Equ. 258 (2015), 483–503.
- [15] T. OZAWA, Long range scattering for nonlinear Schrödinger equations in one space dimension, Comm. Math. Phys. 139 (1991), no. 3, 479–493.



- [16] A. SHIMOMURA AND S. TONEGAWA, Long-range scattering for nonlinear Schrödinger equations in one and two space dimensions, Differential Integral Equations 17 (2004), no. 1–2, 127–150.
- [17] A. SHIMOMURA, Asymptotic behavior of solutions for Schrödinger equations with dissipative nonlinearities, Comm. Partial Differential Equations 31 (2006), no. 7–9, 1407–1423.
- [18] H. SUNAGAWA, Large time behavior of solutions to the Klein-Gordon equation with nonlinear dissipative terms, J. Math. Soc. Japan 58 (2006), no. 2, 379–400.
- [19] Y. TSUTSUMI,  $L^2$ -solutions for nonlinear Schrödinger equations and nonlinear groups, Funkcial. Ekvac. 30 (1987), no. 1, 115–125.
- [20] K. URIYA, Final state problem for systems of cubic nonlinear Schrödinger equations in one dimension, Ann. Henri Poincaré 18 (2017), no. 7, 2523–2542.