**The Nonlinear Schrödinger Equation and Canonical Transformation**

**A. I. Dyachenko**

Landau Institute for Theoretical Physics, 142432, Chernogolovka, Russia

Skolkovo Institute of Science and Technology, Moscow, Russia

Higher School of Economics, Moscow, Russia

Consider 1D NLSE for the field

(1)

in the periodic domain of . Making Fourier transformation of (1) one can get:

(2)

Here

Wave numbers are integers in the periodic domain of . The Hamiltonian of the equation is the following:

Some canonical transformation is applied to (2). This transformation has the following form of infinite series:

(3)

The transformation was constructed using the technique described in.

The series converges only for small values of :

Coefficients (and others) of the canonical transformation are chosen to simplify the Hamiltonian. The transformation removes all nonresonant terms in the Hamiltonian and (what is the most important thing) simplifies the fourth order term. So, that

(4)

Six order term in the Hamiltonian vanishes also (See [2].). For small values of one can consider a reduced Hamiltonian in which only the terms of the fourth order are kept. Then the equation for is also very simple:

(5)

The solution of the equation (5) is trivial:

(6)

Here

does not depend on and is defined by initial conditions only.

**Acknowlegements.** The work was supported by the Russian Science Foundation grant no. 19-72-30028.

References

1. V.E. Zakharov, V.S. Lvov and G. Falkovich,. *Kolmogorov Spectra of Turbulence I,* Springer-Verlag, 1992
2. A.I. Dyachenko, D.I. Kachulin and V.E. Zakharov,  *JETP. Lett.* 2013, 98(1), 43–47.