

Scattering solutions for the focusing nonlinear Schrödinger equation with a potential

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This talk is based on a joint work with Masahiro Ikeda from RIKEN AIP, Japan. We consider the nonlinear Schrödinger equation with a linear potential term:

$$(\text{NLS}_V) \begin{cases} i\partial_t u + \Delta u - Vu = -|u|^{p-1}u, & (t, x) \in \mathbb{R} \times \mathbb{R}^3, \\ u(0, x) = u_0(x) \in H^1(\mathbb{R}^3), \end{cases}$$

where $V = V(x)$ is a real-valued potential. We determine the conditions for the time behaviors of a solution to (NLS_V) , scattering, blowing-up, and growing-up. The conditions are expressed in terms of some quantities which consist of mass and energy. Sharp criteria are given by these quantities of the ground state of the standard NLS, without the potential. If we state more precisely, we give a sufficient condition of the potential and initial data for scattering solutions, and this is a main topic in this talk. Also, we introduce sufficient conditions of the potential and initial data such that blowing-up or growing-up holds at least. Moreover if we add some conditions, we can prove that the solutions must blow-up.