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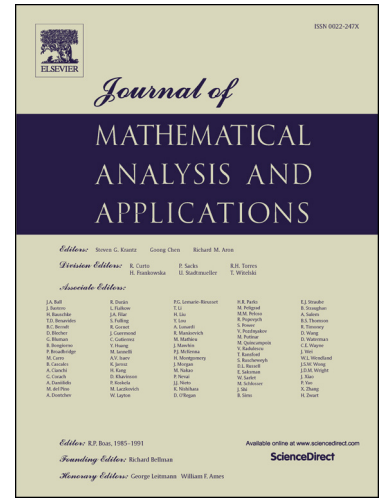
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# Nonrelativistic Approximation in the Energy Space for KGS System

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## Abstract

In this paper we study the nonrelativistic limit of the Cauchy problem for the damped and the conserved Klein-Gordon-Schrödinger (KGS) system, respectively. We prove that any finite energy solution to the damped KGS system converges to the one of Yukawa-Schrödinger(YS) system in the energy space  $H^1 \oplus H^1$ , and the solution to the conserved system goes to the corresponding one of a nonlinear Schrodinger(NLS) equation as well.

**Keywords:** KGS system; Nonrelativistic limit; Uniqueness; Energy convergence.

## 1 Motivation

Klein-Gordon-Schrödinger (KGS) system in  $\mathbb{R}^{3+1}$  describes the dynamics of a nucleon field interacting with a neutral meson field through the Yukawa coupling [16]. It has the form

$$i\partial_t\psi^c + \Delta\psi^c = -\phi^c\psi^c, \quad (1.1)$$

$$\square_c\phi^c + \gamma\partial_t\phi^c + \phi^c = |\psi^c|^2, \quad (1.2)$$

where  $\Delta = \partial_{x_1}^2 + \partial_{x_2}^2 + \partial_{x_3}^2$  and  $\square_c = \frac{1}{c^2}\partial_t^2 - \Delta$  are Laplacian and d'Alembertian, respectively.  $\psi^c(x, t)$  is the conserved complex nucleon field, and  $\phi^c(x, t)$  is the real meson field.  $c$  represents the speed of light and  $\gamma \geq 0$  is a damping constant. For the detailed rescaling process with physical constants, one can also refer to [1, 3]. For a fixed  $0 < c < \infty$ , there is an abundant literature devoted to this system (see [2, 4–7, 9–13]).

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