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Jianhua Chen, Xianjiu Huang, Bitao Cheng



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Positive solutions for a class of quasilinear Schrödinger equations with superlinear condition

Jianhua Chen¹ Xianjiu Huang^{1,†} Bitao Cheng²

*1 Department of Mathematics, Nanchang University, Nanchang, Jiangxi,
330031, P. R. China*

*2 School of Mathematics and Statistics, Qujing Normal University, Qujing, Yunnan,
655011, P. R. China*

Abstract. In this paper, we study the following quasilinear Schrödinger equation

$$-\Delta u + V(x)u + \frac{\kappa}{2}\Delta(u^2)u = f(u), \quad x \in \mathbb{R}^N,$$

where $N \geq 3$, $\kappa > 0$ and $V : \mathbb{R}^N \rightarrow \mathbb{R}$ satisfies suitable assumptions. By using a change of variable, we obtain the existence of positive solutions, which use the method developed by Jeanjean (Proc. R. Soc. Edinburgh Sect. A. 129 (1999) 787-809).

Keywords: quasilinear Schrödinger equation; positive solutions; Pohozaev identity; superlinear condition;

MR(2010) Subject Classification: 35J60, 35J20

1 Introduction

This article is concerned with the following quasilinear Schrödinger equation

$$-\Delta u + V(x)u + \frac{\kappa}{2}\Delta(u^2)u = f(u), \quad x \in \mathbb{R}^N, \quad (1.1)$$

where $N \geq 3$, $\kappa > 0$ and $V : \mathbb{R}^N \rightarrow \mathbb{R}$ satisfies suitable assumptions.

It is well known that it is a hot problem in nonlinear analysis to study the existence of solitary wave solutions for the following quasilinear Schrödinger equation

$$i\partial_t z = -\Delta z + W(x)z - \psi(|z|^2)z + \frac{\kappa}{2}\Delta l(|z|^2)l'(|z|^2)z \quad (1.2)$$

where $z : \mathbb{R} \times \mathbb{R}^N \rightarrow \mathbb{C}$, $W : \mathbb{R}^N \rightarrow \mathbb{R}$ is a given potential, $l : \mathbb{R} \rightarrow \mathbb{R}$ and $\psi : \mathbb{R}^N \times \mathbb{R} \rightarrow \mathbb{R}$ are suitable functions. For various types of l , the quasilinear equation of the form (1.1) has been derived from models of several physical phenomenon. In particular, $l(s) = s$ was used for the superfluid film equation in fluid mechanics by Kurihara [2]. When $\psi(t)$ is a pure power, (1.2) also appears in nonlinear optics, e.g., oscillating soliton instabilities during microwave and laser

[†]To whom correspondence should be addressed. E-mail: cjh19881129@163.com (J. Chen), xjhuangxwen@163.com (X. Huang), chengbitao2006@126.com (B. Cheng).

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