SOLITON AND BISOLITON MODEL FOR PAIRING MECHANISM OF HIGH - TEMPERATURE SUPERCONDUCTIVITY

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Abstract

Soliton is a nonlinear solitary wave moving without energy loss and without changing its form and velocity. It has particlelike properties. The extraordinary stability of solitons is due to the mutual compensation of two phenomena, dispersion and nonlinearity. Solitons can be paired in a singlet state called bisoliton due to the interaction with local chain deformation created by them. Bisolitons are Bose particles and when their concentration is higher or lower than some critical values they can move without resistance. The bisoliton model can be applied for a pairing mechanism in cuprate superconductors due to their layered structure and the relatively small density of charge carriers. Cooper pairs breaking is a result of a paramagnetic effect and the Landau diamagnetic effect. The influence of magnetic impurities and the Meissner effect on cuprate superconductor based on the concepts of the bisoliton model are discussed.

Keywords: Soliton, bisoliton, pairing mechanism, cuprate superconductors, paramagnetic effect, diamagnetic effect, Meissner effect

Introduction

The fascinating nonlinear wave structures known as solitary waves or solitons have become a subject of deeply interested for physicists in recent years. A soliton is a wave packet in which the wave field is localized in a limited (generally propagating) spatial region and is absent outside this region. Soliton, however, differs fundam entally from the classical wave packet which, being a linear formation, is known to spread out rapidly owing to the variation of the group velocity in the whole wavelength range of the packet. Soliton is essentially nonlinear; the(linear) dispersion of the group velocity in it is exactly compensated by the reverse phenomenon, namely, nonlinear self-compression of the wave packet, and therefore the soliton propagates without spreading out and it conservs its shape. Thus, soliton is a nonspreading, nonlinear wave packet in which the phases and amplitudes of the waves are appropriately self-consistent.

It would seem natural to regard exact mutual compensation of dispersion and nonlinearity as being hardly probable and soliton as being a product of the theorists'imagination, rather than a real phenomenon. But, strange as it may seem, numerous theoretical studies and

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