Effects of disorder on soliton dynamics. Part 1. Davydov solitons in |D1⟩ and partial dressing models. Foerner, Wolfgang

Abstract

Within the simple semiclassical |D2⟩ ansatz state the Davydov soliton in protein α-helices remains stable against strong disorder in the sequences of masses, spring consts. of hydrogen bonds, and non-linear coupling consts. However, already weak diagonal disorder or disorder in the dipole coupling consts. between C=O oscillators destroys the soliton. Within the non-classical |D1⟩ ansatz state the soliton appears only for non-linearities roughly 3 to 4 times larger than in |D2⟩ models. The sensitivity of solitons against disorder is practically opposite to that for the |D2) state. Within the partial dressing model only dispersive solitary waves were found, no real traveling solitons. The sensitivity of such waves against disorder is similar to the |D1) case.