Mikhail Shifman

Instantons, Sphalerons and All That in Solar QFT with N=1,2

Abstract

Models with classically degenerate vacua often support quasiclassical configurations of nontrivial topology. In (0+1)-dimensional quantum mechanics with a double-well potential, for example, instantons induce mixing between the two perturbative ground states in the purely bosonic case, while in the supersymmetric version, the tunneling amplitude is suppressed. In this work, we investigate (1+1)-dimensional models featuring classically Bogomol'nyi-Prasad-Sommerfield saturated kinks with degenerate masses and identical topology. We analyze this phenomenon in a supersymmetric framework and demonstrate that, whereas mixing indeed occurs in the bosonic theory, the presence of fermionic zero modes in the supersymmetric case leads to the vanishing of the transition amplitude. To illustrate these results, we examine two examples featuring the Wess-Zumino models with two and four supercharges. The latter example is motivated by the Affleck-Dine-Seiberg superpotential. We also present a number of developments of instanton calculus in the case of instantons in kink backgrounds.