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Boundary Askey–Wilson symmetry and related spectral problem

Boyka Aneva
Theoretical Physics
Bulgarian Academy of Sciences
15 Noemvri Str., 1040 - Sofia
BULGARIA

blan@inrne.bas.bg

Abstract

The sine-Gordon model and affine Toda field theories on the half-line, on the one hand, the XXZ spin chain with nondiagonal boundary terms, and interacting many-body lattice systems with a flow, on the other, have a common characteristic. They possess nonlocal conserved boundary charges, generating a coideal subalgebra of the bulk quantized affine symmetry. We consider a related spectral problem for a system with boundary symmetry based on the Askey–Wilson algebra. The importance of our study is motivated by the representation of one of the boundary algebra generators as the second order difference operator for the Askey–Wilson polynomials, known to be exactly solvable. The difference equation for the Askey–Wilson polynomials becomes equivalent to the diagonalization problem for a general quadratic form in the quantum group generators, interpreted in a proper way as the Hamiltonian of a physical system with boundary Askey–Wilson symmetry. We argue that the boundary Askey–Wilson symmetry is the deep algebraic property allowing for integrability of the physical system in consideration.