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Crystal Interpretation of the Kerov-Kirillov- Reshetikhin Bijection and N-Soliton Solutions of the Box-Ball Systems

Reiho Sakamoto
Department of Physics, Graduate School of Science, University of Tokyo,, Hongo, 7-3-1 Bunkyo-ku, Tokyo 113-0033, Japan

We review recently discovered interplay between the box-ball system which is the celebrated example of soliton cellular automata and the Kerov-Kirillov-Reshetikhin (KKR) bijection which arose from the Behte ansatz. Especially we show (1) the KKR bijection plays the role of the inverse scattering formalism for the box-ball systems, (2) representation theoretic origin of the combinatorial algorism of the KKR bijection is clarified, (3) explicit analytic formula for the KKR bijection and general N-soliton solution for the box-ball systems are obtained – the expression has intimate relationship with the Fermionic formula of the Kostka polynomial, (4) N-soliton solutions for the periodic box-ball system are obtained in terms of ultradiscrete analogue of the Riemann (multivariable) theta function. The part of the talk is based on joint work with A.Kuniba, M.Okado, T.Takagi and Y.Yamada.