The origin of trigonometric K-matrices

Quantum integrability can be characterized by an R-matrix (a solution of the Yang-Baxter equation). Drinfeld observed that the universal R-matrix of a quantum affine algebra acts on tensor products of finite-dimensional representations of the corresponding quantum loop algebra. It results in a matrix-valued formal series $R(z)$ in the multiplicative spectral parameter $z$. If the representations are irreducible, $R(z)$ depends essentially rationally on $z$, so trigonometrically on $\log(z)$.

For quantum integrable systems with boundaries (e.g. open spin chains) K-matrices, solutions of the reflection equation (boundary YBE), have been studied since the 1980s (Cherednik, Sklyanin, Kulish & Sklyanin, Mezincescu & Nepomechie, etc.). In recent joint work with A. Appel we prove the existence of a universal K-matrix and use it in a boundary analogue of Drinfeld's approach. In addition to a quantum affine algebra one must specify a suitable subalgebra (to be viewed as an algebra of residual symmetries, i.e. those compatible with the boundary).

It guarantees a "limitless supply" of trigonometric K-matrices: for each finite-dimensional representation there is a matrix-valued formal Laurent series $K(z)$, satisfying a generalized reflection equation considered by Cherednik in 1992. Again, if the representation is irreducible, $K(z)$ depends essentially rationally on $z$. 