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# From Quantum Q-Systems to Quantum Toroidal Algebras via Generalized Macdonald Operators

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Graded characters of fusion products are understood as Nekrasov-type partition functions or graded conformal blocks. They are closely tied with quadratic relations known as the $Q$-system and its quantum deformation. Acting on the space of symmetric polynomials, solutions of the quantum $Q$-systems act as q-difference operators. These are degenerate, generalized Macdonald operators. The generating functions of the operators corresponding to the symmetric power representations satisfy relations in the quantum affine algebra. Other solutions of the quantum $Q$-system are obtained from these as quantum determinants. The corresponding $t$-deformation of the generating function satisfies relations in the quantum toroidal algebra of $\mathfrak{gl}_1$, hence they can be identified with generators in the elliptic Hall algebra and the spherical DAHA. I will explain these constructions up to the quantum toroidal algebra.

*This is joint work with Philippe Di Francesco.*

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