Quantum groups and quantum vertex algebras

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The vertex algebra theory presents an important connection between theoretical physics and mathematics. It has been extensively studied both by physicists, in the context of two-dimensional quantum field theory, and by mathematicians, due to its applications to representation theory of affine Kac–Moody Lie algebras, finite simple groups and many other areas. As with vertex algebras, the theory of quantum groups originates from theoretical physics, i.e., more specifically, from quantum integrable systems. Moreover, it possesses a wide variety of applications to multiple areas of mathematics, such as knot theory, representation theory of algebraic groups in characteristic p etc. In 1988, I. Frenkel and N. Jing formulated a fundamental problem of developing the so-called quantum vertex algebra theory. One of its key roles is to associate certain vertex algebra-like objects, i.e. quantum vertex algebras, to various classes of quantum groups, such as quantum affine algebras, in parallel with the already established connection between affine Kac–Moody Lie algebras and vertex algebras.

In this talk, I will discuss the aforementioned problem, along with its classical analog which comes from the theory of affine Kac–Moody Lie algebras. Next, I will present some recent results which demonstrate the connection between quantum groups and quantum vertex algebras in the context of quantum affine algebra of type A and Etingof–Kazhdan's quantum vertex algebra associated to the trigonometric R-matrix of the same type. Finally, I will demonstrate some similarities and differences between the classical and quantum setting.