Mathematics > Quantum Algebra

Skein algebras and cluster algebras of marked surfaces

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This paper defines several algebras associated to an oriented surface S with a finite set of marked points on the boundary. The first is the skein algebra Sk_q(S), which is spanned by links in the surface which are allowed to have endpoints at the marked points, modulo several locally defined relations. The product is given by superposition of links. A basis of this algebra is given, as well as several algebraic results.

When S is triangulable, the quantum cluster algebra A_q(S) and quantum upper cluster algebra U_q(S) can be defined. These are algebras coming from the triangulations of S and the elementary moves between them. Natural inclusions A_q(S) into Sk_q^o(S) into U_q(S) are shown, where Sk_q^o(S) is a certain Ore localization of Sk_q(S). When S has at least two marked points in each component, these inclusions are strengthened to equality, exhibiting a quantum cluster structure on Sk_q^o(S).

The method for proving these equalities has potential to show A_q=U_q for other classes of cluster algebras. As a demonstration of this fact, a new proof is given that A_q=U_q for acyclic cluster algebras

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