1059-57-137 **Louis H. Kauffman*** (kauffman@uic.edu), 5530 South Shore Drive, Apartment 7C, Chicago, IL 60637-1946. *Topological Quantum Information, Khovanov Homology and the Jones Polynomial.*

In this paper we give a quantum statistical interpretation for the bracket polynomial state sum $< K >$ and correspondingly for the Jones polynomial. We use this quantum mechanical interpretation to give a new quantum algorithm for computing the Jones polynomial. This algorithm is useful for its conceptual simplicity, and it applies to all values of the polynomial variable that lie on the unit circle in the complex plane. Letting $C(K)$ denote the Hilbert space for this model, there is a natural unitary transformation U from $C(K)$ to itself such that $< K >=< \phi|U|\phi >$ where $|\phi >$ is a sum over basis states for $C(K)$. The quantum algorithm arises directly from this formula via the Hadamard Test. We then show that the framework for our quantum model for the bracket polynomial is a natural setting for Khovanov homology in which the unitary transformation U takes the role of the Jones polynomial, and the eigenvalues of U determine the decomposition of the chain complex for the Khovanov homology. (Received February 22, 2010)