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An Equivariant Rim Hook Rule

In 1999, Bertram, Ciocan-Fontanine and Fulton related quantum multiplication of Schur polynomials to the classical product via rim-hook removal. This is called the "rim-hook rule." Since the LIttlewood-Richardson rule is easily accessible, this means that products in $QH^*(Gr(k,n))$ are also similarly accessible. We provide an equivariant version of this rim-hook rule, explicitly relating the rings $QH_T^*(Gr(k,n))$ and $H_T^*(Gr(k,2n-1))$ or alternately the quantum product of factorial Schur polynomials to the classical product. This allows computations in $QH_T^*(Gr(k,n))$ using combinatorial devices such as Knutson and Tao's puzzles for $H_T^*(Gr(k,n))$. Interestingly, this rule requires a specialization of torus weights that is tantalizingly similar to maps in affine Schubert calculus, which is related to Gromov-Witten theory by Peterson's theorem.