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Gröbner Geometry of Schubert Polynomials Through Ice, Part I

The geometric naturality of Schubert polynomials and the related combinatorics of pipe dreams was established by Knutson and Miller (2005) via antidiagonal Gröbner degeneration of matrix Schubert varieties. We consider instead diagonal Gröbner degenerations. In this dual setting, Knutson, Miller, and Yong (2009) obtained alternative combinatorics for the class of vexillary matrix Schubert varieties. We will discuss general diagonal degenerations, relating them to an older formula of Lascoux (2002) in terms of the 6-vertex ice model. Lascoux's formula was recently rediscovered by Lam, Lee, and Shimozono (2018), as "bumpless pipe dreams." We will explain this connection and discuss conjectures and progress towards understanding diagonal Gröbner degenerations of matrix Schubert varieties.