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Monodromy for the quintic mirror

The mirror to the quintic in \mathbb{P}^4 is the Dwork family X_p of Calabi-Yau 3-folds over a thrice-punctured sphere. As p moves in a loop around each of the three punctures, we can parallel transport classes in $H^3(X_p, \mathbb{Q})$, and observe the monodromy. $H^3(X_p, \mathbb{Q})$ is four-dimensional, and the monodromy can be expressed by matrices in $\mathrm{Sp}(4, \mathbb{Z})$. We showed that these matrices generate a subgroup isomorphic to the free product $\mathbb{Z}/5 * \mathbb{Z}$. The subgroup is dense in $\mathrm{Sp}(4, \mathbb{Z})$, but it was not known whether or not it is of finite index. The fact that it is a free product implies that it cannot be. The monodromy is thus "thin"; this is the first example known of thin monodromy arising algebro-geometrically inside a Lie group of real rank greater than 1.

The Dwork family is one of 14 similar families of CY 3-folds; our methods establish similar results for 7 of the 14 families. For the other 7, it has recently been shown by Singh-Venkataramana and Singh that the monodromy is of finite index, so our result is best possible. This talk is based on joint work with Chris Brav, "Thin monodromy in $\mathrm{Sp}(4, \mathbb{Z})$," *Compositio Mathematica*, 2014.