1120-05-146   **Tri Lai** (`tmlai@ima.umn.edu`) and **Gregg Musiker*** (`musiker@math.umn.edu`). *Beyond Aztec Castles: toric cascades in the dP3 quiver.*

Given one of an infinite class of supersymmetric quiver gauge theories, string theorists can associate a corresponding toric variety (which is a Calabi-Yau 3-fold) as well as an associated combinatorial model known as a brane tiling. In combinatorial language, a brane tiling is a bipartite graph on a torus and its perfect matchings are of interest to both combinatorialists and physicists alike. A cluster algebra may also be associated to such quivers and in this paper we study the generators of this algebra, known as cluster variables, for the quiver associated to the cone over the del Pezzo surface dP3. In particular, mutation sequences involving mutations exclusively at vertices with two in-coming arrows and two out-going arrows are referred to as toric cascades in the string theory literature. Such toric cascades give rise to interesting discrete integrable systems on the level of cluster variable dynamics. We provide an explicit algebraic formula for all cluster variables which are reachable by toric cascades as well as a combinatorial interpretation involving perfect matchings of subgraphs of the dP3 brane tiling for these formulas in most cases. (Received February 19, 2016)