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Combinatorial Interpretation of Birational Rowmotion on Rectangular Posets. Preliminary report.

In this talk, we will elaborate on a theme discussed in the IMA Volume Recent Trends in Combinatorics article "Dynamical algebraic combinatorics and the homomesy phenomenon" by the second author. The combinatorial action of toggling order ideals of a poset may be lifted to the tropical semiring, becoming piece-wise linear (PL) toggling on the associated order polytope of a poset. This can be further lifted to the birational setting by de-tropicalizing the PL toggles hence obtaining rational function formulas in formal variables associated to the elements of a poset. Birational rowmotion is the lift of a combinatorial action known as rowmotion, defined as a sequence of toggles at each element of the poset in a specified order, to this setting.

On special posets, the order of birational rowmotion turns out to be unexpectedly small, in fact the same as for combinatorial rowmotion. In this work, we focus on rectangular posets, i.e., $[n] \times [m]$ where n and m are chosen to be arbitrarily large. We show that iterated applications of birational rowmotion to such a poset yields formulas that can be interpreted in terms of weighted enumeration of non-intersecting lattice paths. We thank AIM for its hospitality during a 2015 workshop where the two authors began this research. (Received August 22, 2016)