Oriented matroids and real rank geometry of ternary forms

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The problem of expressing a homogeneous polynomial as a sum of powers of linear forms is very classical and goes back to the work of Sylvester, Hilbert, and Scorza among others. The real rank of a homogeneous polynomial is the smallest number of linear real forms such that the polynomial admits such a representation. The space parametrizing all real decompositions of a polynomial as a minimal sum of powers is a semialgebraic set sitting inside the classical Varieties of Sums of Powers. We will discuss these real geometric objects for general plane curves of various degrees. For plane cubics, we find a connection with oriented matroids.

This is joint work with Michalek, Moon and Sturmfels.