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*Chromatic symmetric functions and  $e$ -positivity*

Richard Stanley introduced the chromatic symmetric function  $X_G$  of a simple graph  $G$ , an algebraic encoding of all possible proper colorings with colors  $\{1, 2, 3, \dots\}$ . These formal power series are symmetric functions that generalize the chromatic polynomial. In this talk we discuss the algebraic property of  $e$ -positivity, when  $X_G$  can be written as a non-negative sum of elementary symmetric functions. We will also discuss what is known about  $e$ -positivity, and additionally we will resolve Stanley's  $e$ -Positivity of Claw-Contractible-Free Graphs. This is joint work with Angele Foley and Stephanie van Willigenburg.