

# Binary matroids with no $M(K_{3,3})$ -minors.

*Date* Tuesday, April 1

*Time* 4 pm

*Location* 317 Mudd

*Abstract:* A matroid  $M$  consists of a finite set (the ground set of  $M$ ) equipped with a distinguished family of subsets (the independent sets of  $M$ ). In particular, if the ground set is a set of vectors over the field  $GF(2)$ , and the independent sets are precisely those sets that are linearly independent, then  $M$  is a binary matroid.

Every graph  $G$  corresponds in a canonical way to two binary matroids: the cycle matroid  $M(G)$ , and its dual  $M^*(G)$ . The notion of minors extends immediately from graphs to matroids: we can remove an element from a matroid by either contracting or deleting it, and any matroid produced from  $M$  by a sequence of these operations is a minor of  $M$ .

Our result is a structural characterization of the binary matroids that do not have a minor isomorphic to  $M(K_{3,3})$ , where  $K_{3,3}$  and  $K_5$  are the two obstructions to graph planarity. This result leads to a polynomial-time algorithm for an ostensibly intractable problem: given a binary matroid  $M$ , decide if  $M$  has an  $M(K_{3,3})$ -minor. The proof of the characterization is lengthy and depends upon computer checking.

This is joint work with Geoff Whittle and Gordon Royle. No knowledge of matroid theory will be assumed.