

ALGEBRA AND NUMBER THEORY  
SEMINAR

*Geometric equations for matroid varieties*

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**Abstract:** Each point  $x$  in  $Gr(r, n)$  corresponds to an  $r \times n$  matrix  $A_x$  which gives rise to a matroid  $M_x$  on its columns. Gel'fand, Goresky, MacPherson, and Serganova showed that the sets  $\{y \in Gr(r, n) \mid M_y = M_x\}$  form a stratification of  $Gr(r, n)$  with many beautiful properties. However, results of Mnëv and Sturmfels show that these strata can be quite complicated, and in particular may have arbitrary singularities. We study the ideals  $I_x$  of matroid varieties, the Zariski closures of these strata. We construct several classes of examples based on theorems from projective geometry and describe how the Grassmann–Cayley algebra may be used to derive non-trivial elements of  $I_x$  geometrically when the combinatorics of the matroid is sufficiently rich.

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