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Gregory Henselman* (grh@seas.upenn.edu). *Matroids, Morse Theory, and Fast Persistent Homology Computations*. Preliminary report.

The object of this talk is to introduce a set of axioms on a family of flats in a matroid, and the combinatorial theory of finite linear chain complexes that results. This theory is interesting in its own right, with structural analogs to homology, persistence, duality, and, for based complexes, discrete Morse Theory. There is a natural correspondence between linear-algebraic chain complexes and certain of those introduced; this correspondence renders several structures, notably Morse constructions and 1-parameter persistence modules, open to combinatorial methods of analysis that are both elementary and simple. Applications include greatly simplified proofs of results which have historically absorbed much effort in the community of applied topologists, and new insight into structures which remain poorly understood, such as multidimensional persistence. Time permitting, we will discuss future directions in combinatorial sheaf cohomology and applications in algorithm design. No prior knowledge of matroid theory will be assumed. (Received September 15, 2016)