We discuss some ways to quantify how singular a given variety is. We introduce an analytic index of singularities, defined in terms of convergence of a certain integral. This provides a numerical measure of the singularity, sometimes called the log-canonical threshold. Remarkably, this numerical invariant can also be defined using reduction to characteristic $p$: for each $p$, we define a numerical measure of singularities called the F-pure threshold, which has striking fractal-like behavior. Amazing, taking the limit as $p$ goes to infinity, we recover the analytically defined log canonical threshold. We will discuss these theorems and some deep open questions that remain at the frontier of this topic.

Karen Smith is the M. S. Keeler Professor of Mathematics at the University of Michigan. In 2001 she was awarded the Ruth Lyttle Satter Prize “for her outstanding work in commutative algebra, which has established her as a world leader in the study of tight closure, an important tool in the subject introduced by Hochster and Huneke. It is also awarded for her more recent work which builds new bridges between commutative algebra and algebraic geometry via the concept of tight closure.”

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