1124-15-240 **Lek-Heng Lim*** (lekheng@galton.uchicago.edu) and **Shmuel Friedland**. *From secant varieties to nuclear norm balls.*

It is well-known that for $d > 2$, the set of d-tensors of rank $\leq r$ is not a closed set. The usual approach to remedy this is to take Zariski closure (in this case equivalent to Euclidean closure) to obtain the rth secant variety. While the secant variety is attractive for various reasons (e.g., cut out by polynomials; defined over arbitrary fields), it is not so from an applications perspective (e.g., border rank-r tensors may have ranks much larger than r; there is no general expression for a border rank-r tensor). We propose an alternative way of 'closing up' the set of rank-r tensors over $\mathbb{C}$ or $\mathbb{R}$, namely, using tensor nuclear norm as a continuous proxy for tensor rank. Tensor nuclear norm has properties much like tensor rank (e.g., base field dependence, NP-hard to compute) but is somewhat easier to study (e.g., one can prove Comon conjecture for tensor nuclear norm) because of properties (e.g., convexity, dual norm) peculiar to a norm. In addition, we will show that it gives rise to a notion of tensor *nuclear rank*, a nuclear norm attaining decompositions with a minimum number of rank-1 terms. Among other properties, the set of d-tensors of nuclear rank $\leq r$ will always be a closed set. (Received September 10, 2016)