SALEH MUSTAFA, University of Regina
Higher Rank Numerical Ranges for Certain Non-normal Matrices

The concept of higher numerical range was introduced by Choi, Kribs, and Zyczkowski in 2006, as a matrix-analysis tool to find correctable codes for a quantum channel. Concretely, given $T \in M_n(\mathbb{C})$ its k^{th} higher numerical range is the set

$$\Lambda_k(T) = \{\lambda \in \mathbb{C} : \exists P \in \mathcal{P}_k(n) : PTP = \lambda P\},$$

where $\mathcal{P}_k(n)$ is the set of projections of rank k (i.e., $P \in M_n(\mathbb{C})$ such that $P^2 = P = P^*$ and $\mathrm{Tr}(P) = k$).

The higher numerical ranges of normal matrices are well-understood, but little is known in general, other than the fact that $\Lambda_k(T)$ is always compact and convex. In this talk I will show how to calculate $\Lambda_k(T)$ for certain non-normal matrices T, namely direct sums of Jordan blocks $T = \bigoplus_{j=1}^{m} J_{n_j}(\alpha)$, and direct sums of the form $T = J_n(\alpha) \oplus \beta I_m$.