1125-55-2595 **Joshua Lee Mike*** (mike@math.utk.edu) and **Vasileios Maroulas**. *Combinatorial Hodge Theory for Equitable Kidney Paired Donation.* Preliminary report.

The problem of Kidney Paired Donation (KPD) has traditionally been approached within an integer programming framework. Here we adopt computational topology methods to find kidney exchange cycles. Employing Hodge theory, we decompose the edge flow describing the KPD pool into three parts. The curl portion of the flow represents local cycles and is trivial here. The gradient portion creates a scoring that we use to measure inequity in the kidney exchange. This scoring measures typical cases of disparity within a KPD pool, specifically that under demanded pairs and highly sensitized patients have lower scores than typical patient-donor pairs. The last portion of the decomposition is used to guide our search for kidney exchange cycles by capturing the 1-cohomology of the kidney exchange graph and investigating the tendency of the donations to occur in cycles. Further results demonstrate that PD pair score and the chance to obtain a kidney are positively correlated when using top trading cycles and chains; in contrast, we show that our method eliminates disparity in a KPD pool, i.e. the chance to obtain a kidney through our method is independent of score. (Received September 20, 2016)