Probabilistic Operator Algebra Seminar

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August 31 **Allen Tannenbaum**, Stony Brook University

Title: *Matrix Monge-Kantorovich Theory: A Quantum Mechanical Approach*

The classical Monge-Kantorovich (MK) problem as originally posed is concerned with how best to move a pile of soil or rubble to an excavation or fill with the least amount of work relatives to some cost function. When the cost is given by the square of the Euclidean distance, one can define a metric on the space of probability densities called the Wasserstein distance. In this lecture, we will describe a natural matrix counterpart of the MK problem for positive-definite density matrices using ideas from quantum mechanics, in particular, the Lindblad equation describing open quantum systems. We prove a number of results about this metric including showing that it can be formulated as a convex optimization problem, strong duality, an analogue of the Poincare-Wirtinger inequality and a Lax-Hopf-Oleinik-type result. The work may be regarded as possible non-commutative extension of the classical theory. We will also explore some possible applications to quantum information and networks.