Title: Topology, probability and quantum

Abstract: Our experience of the physical world is essentially shaped by the act of measurement. In abstract terms a measurement can be described by a probability table consisting of a collection of measurements and the probabilities assigned to the occurrence of each outcome. When there are more than two parties, say Alice and Bob, performing measurements the resulting probability tables are dramatically different for quantum measurements, than their classical counterparts. The mathematical theory of quantum mechanics is based on Hilbert spaces and operators acting on them and Born's rule tells us how to extract probabilities as the result of a measurement. A quirky feature of quantum is observed when Alice and Bob perform measurements on entangled states. In these cases the probability tables cannot be reproduced by classical measurements. This feature, known as quantum contextuality, plays a prominent role in computational advantage in quantum computers. Topology enters the picture at this point as an intrinsic structure of the collection of measurements. In this talk I will explain how the theory of simplicial sets, combinatorial representations of topological spaces in modern homotopy theory, can be enriched into a probabilistic version that can be used to study this fundamental quantum phenomenon.