# On the combinatorial structure of types of higher order quantum maps

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**Abstract**

Higher order quantum maps (HOM) form a hierarchy describing most general protocols of quantum information processing. This hierarchy that can be built recursively, starting from elementary systems and including at each step all admissible transformations between objects constructed in previous steps. Loosely speaking, the HOM can be described as "transformations between transformations" satisfying certain admissibility conditions.

The recursive construction leads to a formalism of types of HOMs (Bisio and Perinotti, 2019), which have a combinatorial characterization that can be given it terms of certain boolean functions - the type functions. We show that to every type function we can find a finite poset which fully characterizes the type, and that the causal (or signaling) structure of HOMs of the given type can be infered from this poset.

The purpose of this talk is to introduce these posets and the related problems to the algebraic community.