Order preserving maps on quantum measurements

Maria Jivulescu
University Politehnica Timişoara, ROUMANIE
maria.jivulescu@upt.ro

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In this talk we present our studies about the partially ordered set of equivalence classes of quantum measurements endowed with the post-processing partial order. The post-processing order is fundamental as it enables to compare measurements by their intrinsic noise and it gives grounds to define the important concept of quantum incompatibility. Our approach is based on mapping this set into a simpler partially ordered set using an order preserving map and investigating the resulting image. The aim is to ignore unnecessary details while keeping the essential structure, thereby simplifying e.g. detection of incompatibility. One possible choice is the map based on Fisher information introduced by Huangjun Zhu, known to be an order morphism taking values in the cone of positive semidefinite matrices. We explore the properties of that construction and improve Zhu's incompatibility criterion by adding a constraint depending on the number of measurement outcomes. We generalize this type of construction to other ordered vector spaces and we show that this map is optimal among all quadratic maps. The results are joint work with Teiko Heinosaari and Ion Nechita (arXiv:2202.00725).