On Boolean posets of numerical events

Dietmar Dorninger and Helmut Länger

Abstract

With many physical processes in which quantum mechanical phenomena can occur it is essential to take into account a decision mechanism based on measurement data. This can be achieved by means of so-called numerical events, which are specified as follows: Let S be a set of states of a physical system and $p(s)$ the probability of the occurrence of an event when the system is in state $s \in S$. A function $p\colon S \to [0,1]$ is called a numerical event or alternatively, an S-probability. If a set P of S-probabilities is ordered by the order of real functions it becomes a poset which can be considered as a quantum logic. In case the logic P is a Boolean algebra this will indicate that the underlying physical system is a classical one. The goal of this paper is to study sets of S-probabilities which are not far from being Boolean algebras by means of the addition and comparison of functions that occur in these sets. In particular, certain classes of so called Boolean posets of S-probabilities are characterized and related to each other and descriptions based on sets of states are derived.