Opponent Assessment of Bachelor's Thesis

Name: Hidden variables in mathematical models of quantum structures
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The thesis deals with the hidden variable hypothesis (HVH) in quantum mechanics. The HVH states, in a simplified form, that a quantum mechanical experiment can be treated "classically" (i.e., subject to the Newtonian mechanics) if we only knew the "hidden variables" of the experiment. In the logico-algebraic approach to the mathematical foundation of quantum theories, the HVH is rephrased in the requirement of an abundance of two-valued (probability) measures (alias states) on the corresponding quantum logic, and this in turn means that the quantum logic is set-representable (S.P.Gudder: Stochastic Methods in Quantum Mechanics, North Holland, New York ,1979). It is this question of the set-representation of quantum logics, the latter being identified with orthomodular posets, that is mainly investigated in the thesis. The author of the thesis first situates the problems to be pursued within the theory of orthomodular structures. He shows why he refuses the Hilbert space logics as inappropriate for his intention (certain consequences of Gleason's theorem, Kochen-Specker's theorem, etc.). He then concentrates on finite quantum logics and, specifically, on those that are determined by so called Greechie diagrams. These diagrams define atomistic quantum logics and usually allow for a rather good visualization. The main problem then is whether or not one can assign the values 0 and 1 to the atoms in such a manner that the assignment constitutes a state. Also, the size of different assignments plays an important role. This is where the computers help. The author considerably contributes to the formerly used programs (in particular to MINRE developed by Russian mathematicians). He clarifies several questions concerning the economy of constructions. Notably, he sheds light on the question of constructing a minimal set-representation in the case, needless to say, that such a representation exists which the author's program also verifies.

The thesis is written in a reasonably professional style and brings several new views and results. It contributes to the understanding of orthomodular combinatorics. I considerably value the thesis and classify it   A (excellent).

9.6.2016.   Prof. RNDr. Pavel Pták, DrSc.