Abstracts: Workshop "Quantum logic and probability 2 0 0 7"

22.11. - 25.11. 2007

Department of Mathematics and Descriptive Geometry
Faculty of Civil Engineering
Slovak University of Technology, Bratislava

Scope of the workshop: Quantum logic and probability 2 0 0 7

Quantum structures

Quantum probability

Causality

Applications

Abstracts: Abstracts should be submitted by October 31, 2007 to the secretary of the International Scientific Programme Committee Mgr. Ahmad Mohammed Al-Adilee (mohammed(at)math.sk) with subject" quantum 2007" specified

Important: Application form should be submitted before 30th September, 2007 to workshop secretary mohammed@math.sk The contributions of the workshop will be involved in a special number of the journal Information Sciences. Deadline for submitting the papers are 1st of December 2007.

The official workshop language will be English. Simultaneous interpretation will not be available.

Programme committee

Enrico Beltrametti (Italy),
Andrei Khrennikov (Sveden),
Oľga Nánásiová (Slovakia).
Mirko Navara (Czech Republic),
Sylvia Pulmannová (Slovakia),
Jaroslaw Pykacz (Poland),
Zdenka Riečanová (Slovakia),
Karl Svozil (Austria)

Organization committee

Mária Minrová, Oľga Nánásiová, Štefánia Václavíková, Ľubica Vaášková, Martin Kalina, Ahmed Mohammed Al-Adilee

Program Workshop: Quantum Structures
Slovak University of Technilogy,
Faculty of Civil Engineering,
Radliskeho 11, Bratislava, Slovakia
22nd- 25st November, 2007

Thursday 22. 11. 2007 4th floor, seminars room Department of Mathematics

14:00 Registration

16:00 Round table open problems

Friday 23.11. 2007 Seminar's room, the second floor

chairman: Riečanová Zdenka

9:00 Pulmannova Sylvia, Slovakia: *Sharp and unsharp observables*

9:30 Hudson Robin, Great Britain: *Causal and rectangular double products in quantum stochastic calculus*

10:00 Pykacz Jaroslaw, Poland: *Arbiter as the Third Man in classical and quantum games*

Coffee break 10:00 - 10:45

chairman: Pykacz Jaroslaw

10:45 Riečanová Zdenka, Slovakia:*Pseudocomplemented effect algebras and the existence of states*

11:15 Paseka Jan, Czech Republik: *Atomic Archimedean lattice effect algebras*

11:45 Navara Mirko, Czech Republik: *Constructions of stateless quantum structures*

chairman: Navara Mirko

14:00 Kalina Martin, Slovakia *Conditional states on MV-algebras*

14:30 Ma Zhihao, China: *Ideals of Effect Algebras*

15:00 Kalmbach Gudrun, Germany: *6 dimensions*

Coffee break 15:00 - 15:30

chairman: Hudson Robin

15:30 Dohnal Gejza, Czech Republik: *Markov Property in Quantum Logic. A reflection*

16:00 Valášková Ľubica, Slovakia: *An OML and special functions*

Saturday 24.11. Seminar's room, the second floor

chairman: Paseka Jan

9:00 Khrennikov Andrei, Sweden: *Quantum-like Description of Probabilistic Data for disjunction effect in psychology*

9:30 Svozil Karl, Austria: *Quantum Scholasticism: On Quantum Contexts, Counterfactuals, and the Absurdities of Quantum Omniscience*

Coffee break

chairman: Pulmannova Sylvia

10:30 Mohammed Ahmed Al-Adilee, Slovakia: *S-map and copula function*

11:00 Nánásiová Oľga, Slovakia: *Conditionality and causality*

Conclusion

Abstracts

Markov Property in Quantum Logic. A reflection.

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The Markov processes are of proven utility in a wide area where applications of probability theory can be used. In the classical probability theory, the special processes were introduced by russian mathematician A. A. Markov in the first decade of previous century. The famous Markov property means some kind of memoryless. The stochastic proces, which approached some of its possible state in given time, it can forget its history to decide of by which way it will continue. The only sufficient information for such decision is a knowledge of the present state. In physics, there was used the idea of Markov property in the connection with the causality model in branching space-times, so called *causal Markov condition.*

In my contribution, I present a way of introducing the Markov property within the framework of orthomodular quantum logic, which is commonly used as the calculus model for quantum mechanics. Toward such construction we need some dynamical structure on an orthomodular lattice. As a transition in this context, can be viewed the famous implication which does satisfy the law of entailement on orthomodular lattice, the so-called Sasaki hook. The action of Sasaki hook assigns causes and has a fundamental dynamic nature.

Causal and rectangular double products in quantum stochastic calculus.

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Doble products of the form $\Pi_{s<x<y<t}(1+r(dx,dy))$ and $\Pi_{a<x<b,s<y<t}(1+r(dx,dy))$ are defined and their properties compared, where r is an element of the tensor product with itself of the algebra of Ito differentials in a quantum stochastic calculus. Applications, of the causal product to a quantum Girsanov theorem and associated Black-Scholes model, and of the rectangular product to construction of quantum groups, will be described if time allows.

Conditional states on MV-algebras

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This is a continuation of our previous work [1], where some problems were left open.We will consider the system of [0, 1]-valued functions as the MV-algebra M.Further we show that a slight modification of this model is possible also if $\nu$is additive, but not σ-additive.

[1] Kalina M., Nanasiova O.: Conditional state and joint distributions on MV-algebras (2006), Kybernetika vol. 42, 129-142

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6 Dimensions

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100 Years ago:

The good solutions of differential equations for physical processes requiered for wave descriptions that in physics time as a linear fourth dimension was generally accepted.

Real R^4 is spacetime used in physics today. Since then particle series showed in the nano range that world maybe higher dimensio- nal. String theory uses 10-11 or up to 27 dimensions, some of them they claim are rolled. There is no experimental finding for this.

I work in a complex 3-dimensional, real 6-dimensional operator generated model C^3 or R^6. To spacetime is added an energy-plane with coordinates (iu,iw) for frequency as energy E=hf and mass as energy $E = mc^2$. This space is projected in real spacetime R^4.

Particle theory is guided by symmetry groups. I introduce first the special linear symmetry group SU(2). An example from the projective SU(2)- geometry of electromagnetism EM associated with the weak force WI (I stands for interaction between two systems) in atomic kernels is:

The electrically charged exchanged WI-particles W^+, W^- or the neutral Z^0 are intermediate energy-carriers, - in the SU(2)-geometry a 3-dimen- sional scaled unit-ball S^3 in R^4, mapped by the Hopf map and using the 3 Pauli-spin matrices of 3-dimensional spin of particles in two solid 3-dimensional balls B in space R^3 with boundaries available through the Heegaard-decompositions of S^3 where n solid toroidal handles can be added to B carrying charges. Unit spheres S^n in some $R^(n+1)$ or toroidal structures such S^1xS^1 or S^3xS^5 (the geometry of SU(3) the strong interaction) are used for locally rolled coordinates of systems and particles.

Quantum-like Description of Probabilistic Data for disjunction effect in psychology

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In this paper we present quantum-like (QL) representation of the Shafir-Tversky statistical effect. We apply so called contextual approach. The Shafir-Tversky effect is considered as a consequence of combination of a number of incompatible contexts which are involved e.g. in Prisoner's Dilemma or in more general games inducing the disjunction effect. As a consequence, the law of total probability is violated for experimental data obtained by Shafir and Tversky (1992) as well as Tversky and Shafir (1992). Moreover, we can find a numerical measure of contextual incompatibility (so called coefficient of interference) as well as represent contexts which are involved in Prisoner's Dilemma (PD) by probability amplitudes – normalized vectors ("mental wave functions"). We remark that statistical data from Shafir and Tversky (1992) and Tversky and Shafir (1992) experiments differ crucially from the point of view of mental interference. The second one exhibits the conventional trigonometric (cos-type) interference, but the first one exhibits so called hyperbolic (cosh-type) interference. We discuss QL processing of information by cognitive systems, especially, QL decision making as well as classical and QL rationality and ethics.

Copula function on an OML

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The copula function contains all the information on the dependence between a set of random variables that can be given depending on the marginal distribution. In effect, the information on the marginal and the information on the dependence are neatly separated from each other.we put these properties without proofs and we will used the notion in Nelson(1999).

The situation charges when non-standard spaces are considered. For example, it is a well known that the set of random events in quantum mechanics experiments is a more general structure than Boolean algebra. As a basic model we consider an orthomodular lattice. It has the same properties as a Boolean algebra except of distributivity.

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Caussality and conditionality

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The theory of orthomodular lattice and its relationships that depend on smap and conditional states definitions has shown in several types of probabilistic relations. An orthomodular lattice with a conditional states can be applied and defined as a model for non-compatible events. Studying of s-maps or conditional states on an orthomodular lattice helps us to describe such properties of random events, which are difficult to be described by Boolean algebra, for example causal system.
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Special functions on an OML

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We will study functions Q_i $(i = 1, 2, 3)$ for two variables on a quantum logic L such that, for each compatible elements $a, b \in L$ $Q_1(a, b) = m(a \vee b)$, $Q_2(a, b) = m(a \triangle b)$ and $Q_3(a, b) = m(a \wedge b)$, where m is a state on L. We show some examples of such functions and there basic properties.
Acknowledgement This work was supported by Science and Technology Assistance Agency under the contract No. APVV-0375-06, VEGA-1/4024/07, VEGA-1/3014/06

Constructions of stateless quantum structures

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Pasting techniques allow to paste Boolean algebras (*blocks*) together in order to obtain orthomodular posets or lattices. They enriched the theory of quantum structures by numerous examples, see [2, 3, 4, 6]. Their possibilities were clarified in [1, 4], where necessary and sufficient conditions are stated.

The corresponding geometrical technique is now used under the notion of *Greechie diagrams*. They were first used to find an example of a finite orthomodular lattice which admits no states [3]. Although this result can be considered negative in its meaning, it inspired many subsequent constructions leading to deep positive results. The first among them was the proof that every compact convex set is affinely homeomorphic to the state space of some orthomodular lattice [9]. An overview of subsequent results can be found in [7].

The Greechie's main example of has been simplified by R. Mayet [5] who constructed a stateless orthomodular lattice with 19 blocks and 30 atoms. The principle is that there are two coverings of all atoms by blocks which do not intersect in atoms. One covering has 10 blocks, the other 9 blocks.

As a new result, we have proved that this technique does not admit a smaller example, thus the result of R. Mayet is optimal. This still does not deny the possibility that another idea could lead to a smaller example, but this is rather improbable because the technique by Greechie and Mayet proved to be much more efficient than any other concurrent tool.

On the other hand, we know for sure that every orthomodular lattice with up to 5 blocks admits a state [8]. The gap between (from 6 to 18 blocks) remains still open for future investigation.

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atomic lattice effect algebra with at most five blocks. Preprint, 2007.

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Atomic Archimedean lattice effect algebras

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The existence of states on effect algebras (even orthomodular lattices) is still an open question. During the study concerning the existence of two-valued states on atomic lattice effect algebras we proved that two complete atomic lattice effect algebras are isomorphic iff there is a bijection between the atoms that preserves the compatibility relation and the isotropic index. As a consequence, a special case for a characterization of zero sets of (o)-continuous two-valued states is obtained.

Arbiter as the Third Man in classical and quantum games

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We study possible influence of not necessarily sincere arbiter on the course of classical and quantum static 2x2 games and we show that this influence in the quantum case is much bigger than in the classical case. Extreme sensitivity of quantum games on initial states of quantum objects used as carriers of information in a game shows that a static quantum game, contrary to a classical game, is not defined by its payoff matrix alone, but also by an initial state of objects used to play a game. Therefore, two quantum games that have the same payoff matrices bur begin with different initial states of objects used to play them should be considered as different games.

Quantum Scholasticism: On Quantum Contexts, Counterfactuals, and the Absurdities of Quantum Omniscience

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In classical physics, there is just one global context which is trivially constituted by all conceivable observables. Hence, there is no conceptual or principal reason to assume counterfactuals; sometimes they are just considered for convenience (saving the experimenter from measuring redundant observables). The empirical sciences implement classical omniscience by assuming that in principle all observables of classical physics are (co-)measurable without any restrictions. No distinction is made between an observable obtained by an actual and a potential measurement. Precision and (co-)- measurability are limited only by the technical capacities of the experimenter. The principle of empirical classical omniscience has given rise to the realistic believe that all observables exist, regardless of their observation; i.e., regardless and independent of any particular measurement. Physical (co-)existence is thereby related to the realistic assumption [31] (sometimes referred to as the ontic [32] viewpoint) that such physical entities exist even without being experienced by any finite mind.

Ideals of Effect Algebras

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In this paper, we show that in a lattice eect algebra, each lattice ideal is an eect algebra ideal i the lattice eect algebra is an orthomodular lattice.

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