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An Overview of the 1997 IQSA Meeting in Atlanta

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The International Quantum Structures Association (IQSA) met in Atlanta the week of October 12, 1997, principally to plan its 1998 biannual meeting. This was a historic meeting as it was the first to be held in the United States. As is its custom whenever its members assemble, scientific ideas were exchanged, not only informally, but also in the form of research papers presented formally to the group. Many of these papers have been written up for publication. Some of them have been published elsewhere; others are being modified and will eventually appear in an evolved form, but a representative portion of them were submitted to this journal, have survived the refereeing process, and are assembled here to be published together.

The papers are fairly representative of IQSA's activities. They are loosely assembled into three clusters. The first consists of those papers which focus on the so-called orthomodular structures or closely related structures. These are the (sometimes partial) algebraic structures (in order of increasing generality): Boolean algebras, orthomodular lattices, orthomodular posets, orthoalgebras, and effect algebras.

Cattaneo, Dalla Chiara, and Giuntini, working in the setting of effect algebras or their lexicomorphic cousins quantum-MV-algebras, delineate six notions of "sharp physical property." They study the relationships among these notions and show, among other things, that these six notions collapse into one in an MV-algebra.

Navara discusses a theorem that insures the existence of an orthomodular lattice (OML) with certain prespecified state space properties given that a certain quite weak structure exists with the same property. These weak structures are, in fact, weaker than all the orthomodular structures listed above. He therefore provides us with a simple means of showing that OMLs exist with certain state space properties.

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Gudder studies effect algebras with a convex structure. He presents a representation theorem of such structures as a generating interval in an ordered linear space. This elegant result generalizes an earlier result of M. Stone.

Foulis and Greechie study probability weights and measures on finite effect algebras. They extend many of the earlier results for richer orthomodular structures to effect algebras. In so doing they develop and consolidate the resulting theory, paying particular attention to the finite case with computational applications lurking in the background.

Riečanová studies effect algebras, their close cousins D-posets and D-algebras, and their generalized versions in which one bound is missing. This latter development follows contributions for generalized orthomodular structures made by Abbott (for Boolean algebras), Janowitz (for orthomodular lattices), Mayet-Ippolito (for orthomodular posets), and Hedlikova and Pulmanová (for D-posets). The principal result is a characterization of the center of a generalized effect algebra.

The second cluster consists of those papers that involve calculations in the standard quantum logic, make an application or a criticism of the standard model for quantum physics, or speculate on control mechanisms in biological systems motivated by quantum tensor products.

Chumakov, Hellwig, and Klimov present a derivation of the entropy of a quantum system with a finite-dimensional Hilbert space in terms of purities; they provide an evaluation (up to the second order in time) of the time-dependent entropy of such a system which at time $t = 0$ starts interacting with another quantum system; the Jaynes–Cummings model is considered as an application.

Aerts, Broekaert, and Smets propose a quantum mechanical modeling of the "liar paradox." The liar is an entity considered to "exist" within a cognitive layer of reality. The modeling is motivated by the fact that such layers of reality, as in quantum mechanics, are highly contextual. A cognitive act corresponds to a measurement which sets into motion the dynamic change of state of truth values characteristic of such paradoxes.

Garola presents an illucidation of a philosophical position presented elsewhere in which he criticizes the standard interpretation of quantum physics as empirical verificationism. This position, called Semantic Realism, is potentially controversial, principally because it assigns meaning even to certain untestable statements.

McCollum presents an update of ongoing efforts to develop a formal bridge between theoretical neuroscience and quantum logic. This approach attempts to lay a foundational mathematics in neurobiology. It proposes a way of combining primitive sensorimotor control systems into more complicated structures; the combination is similar to the tensor product in quantum logic.

The third cluster consists of mathematical excursions related to generalizations of a well-established approach to the foundations of quantum mechanics, an investigation of finite-field-valued measures, a neat proof of a known result in functional analysis, and an attempt to merge three seemingly different notions of summability in an orthoalgebra.

Coecke and Stubbe propose the introduction of unitary quantales in order to generalize the description of states as presented by the Geneva/Brussels school. A certain map, the operational resolution, relates states to operational properties.

Verriest and Narayanan discuss "probability and expectation" over finite fields and discover that an elementary symmetric random walk in GF(p) refocuses after p steps and, if the number of steps is sufficiently small relative to p, then the random walk is indistinguishable from the random walk described on an integer lattice.

Olubummo and Cook present a shortened and simplified proof of a known result by Ellis that a Banach space which is the predual of an order-unit space is a base normed linear space.

Schröder, working in the setting of orthoalgebras, studies several notions of summability previously introduced separately by Younce, Habil, and Wilce. He shows that they are almost equivalent; and he presents a condition which, if verified, would complete the proof that they are equivalent.

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