Local quantum field logic

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Algebraic quantum field theory, or AQFT for short, is a rigorous analysis of the structure of relativistic quantum mechanics [4]. It is formulated in terms of a net of operator algebras indexed by regions of a Lorentzian manifold. In several cases the mentioned net is represented by a family of von Neumann algebras, concretely, type III factors. In this perspective, a logical system can be established capturing the propositional structure encoded in the algebras of the mentioned net. In this framework, this work contributes to the solution of a family of open problems, emerged since the 30s, about the characterization of those logical systems which can be identified with the lattice of projectors arising from the Murray-von Neumann classification of factors [1,2,3]. More precisely, based on physical requirements formally described in AQFT, an equational theory able to characterize the type III condition in a factor is provided. This equational system motivates the study of a variety of algebras, concretely a discriminator variety, having an underlying orthomodular lattice structure. A Hilbert style calculus, algebraizable in the mentioned variety, is also introduced and a corresponding completeness theorem is established.

Referencias

[1] L. J. Bunce, J. D. Maitland Wright, Quantum Logic, State Space Geometry and Operator Algebras, Comm. Math. Phys. 96 (1984) 345-348.

[2] H. Gross, Hilbert lattices: New results and unsolved problems, Found. Phys. 20 (1990), 529-559.

[3] S. Holland, The Current Interest in Orthomodular Lattices, in: J. C. Abbott, (ed), Trends in Lattice Theory, Van Nostrand-Reinhold, New York (1970) pp. 41-26.

[4] J. Yngvason, The role of type III factors in quantum field theory, Rep. Math. Phys. 55 (2005), 135-147.