quantum logic toposes

Canonical name	QuantumLogicToposes
Date of creation	2013-03-22 18:13:18
Last modified on	2013-03-22 18:13:18
Owner	bci1 (20947)
Last modified by	bci1 (20947)
Numerical id	29
Author	bci1 (20947)
Entry type	Topic
Classification	msc 81P68
Classification	msc 18B25
Classification	msc 81P15
Classification	msc 81P10
Synonym	extended quantum topos
Related topic	AxiomsOfTopoi
Related topic	GeneralizedToposesTopoiWithManyValuedLogicSubobjectClassifiers
Related topic	AlgebraicCategoryOfLMnLogicAlgebras
Related topic	QuantumLogic
Related topic	QuantumOperatorAlgebrasInQuantumFieldTheories
Related topic	Topos
Defines	quantum logics topoi
Defines	quantum logics toposes
Defines	toposes with quantum logics subobject classifiers

This is a topic entry on extensions of standard and elementary toposes to *quantum topoi* founded upon many-valued logics.

Definition 0.1. *A quantum logic topos* (*QLT*) is defined as an *extension of the concept of a topos* in which the Heyting algebra or subobject classifier of the standard elementary topos is replaced by a *quantum logic* that is axiomatically defined by a *non-commutative* lattice structure such as that of a many valued, LM_n-logic algebra, modified to a non-distributive lattice structure corresponding to that of the quantum physics events.

Remark 0.1. Quantum logics topoi are thus generalizations of the Birkhoff and von Neumann definition of quantum state spaces based on their definition of a quantum logic (lattice), as well as a *non-Abelian*, higher dimensional extension of the recently proposed concept of a 'quantum' topos which employs the (*commutative*) Heyting logic algebra as a subobject classifier.

Some specific examples are considered in the following two recent references.

References

[1] Butterfield, J. and C. J. Isham: 2001, space-time and the philosophical challenges of quantum gravity., in C. Callender and N. Hugget (eds.) *Physics Meets Philosophy at the Planck scale.*, Cambridge University Press,pp.33–89.

[2] Butterfield, J. and C. J. Isham: 1998, 1999, 2000–2002, A topos perspective on the Kochen–Specker theorem I - IV, *Int. J. Theor. Phys*, **37** No 11., 2669–2733 **38** No 3., 827–859, **39** No 6., 1413–1436, **41** No 4., 613–639.