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quantum space-times

Canonical name	QuantumSpacetimes
Date of creation	2013-03-22 18:15:56
Last modified on	2013-03-22 18:15:56
Owner	bci1 (20947)
Last modified by	bci1 (20947)
Numerical id	28
Author	bci1 (20947)
Entry type	Topic
Classification	msc 81R60
Classification	msc 81R50
Classification	msc 81P10
Classification	msc 83C47
Classification	msc 83C75
Classification	msc 83C45
Classification	msc 81P05
Synonym	QST
Synonym	quantum state spaces
Synonym	quantum spaces
Related topic	QuantumFundamentalGroupoids
Related topic	QuantumGroupoids2
Related topic	QuantumGroups
Related topic	QuantumSystem
Related topic	QEDInTheoreticalAndMathematicalPhysics
Related topic	HamiltonianOperatorOfAQuantumSystem
Related topic	QuantumChromodynamicsQCD
Related topic	QuantumAutomataAndQuantumComputation2
Related topic	Quantization
Related topic	QEDInTheoreticalAndMathema
Defines	quantum space-time structure
Defines	QST

This is a contributed topic on quantum space-times viewed from general relativistic and quantum gravity standpoints, and includes, for example, quantum geometry fundamental notions.

1 Quantum Space-times (QST)

The concept of *quantum space-times (QST)* is fundamental to the development of relativistic quantum theories and at this point it can only be broadly defined as a *class of mathematical spaces that allow the construction of quantum physical theories in a manner consistent with both relativistic principles and quantum gravity.* There is no universal agreement amongst either theoretical physicists or mathematicians who work on Physical Mathematics about either a specific definition of such quantum space-times or how to develop a valid classification theory of quantum space-times. However, several specific definitions or models were proposed and a list of such examples is presented next.

1.1 Specific Definitions for Models of Quantum Space-Times (QSTs) and Quantum Geometry

- QSTs represented by posets or causal sets

- QSTs represented by so-called quantum topoi (QTs) with Heyting logic algebra as a subobject classifier

- QSTs represented by Topological Quantum Field Theories (TQFTs) or Homotopy QFTs

- QSTs represented as http://planetmath.org/SpinNetworksAndSpinFoams spin foams of spin networks

- QSTs represented as a noncommutative, algebraic– and/or "geometrical"–quantized space as in noncommutative geometry models for SUSY

- QSTs represented as generalized Riemannian manifolds with quantum tangent spaces

- QSTs represented as presheaves of local nets of quantum operators in Algebraic QFT

- QSTs represented as quantum fields (QF) on a (physical) lattice of geometric points

- QSTs represented as consisting of quantum loops

- QSTs represented as fractal dimension spaces

- QST represented as a quantum category of locally compact grpoupoids

- QSTs represented as categories or spaces of quantized strings as in string theories

- Twistor representations in quantum gravity (QG) (introduced by Sir Roger Penrose).