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Integral quantization and quantum time

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Quantization of classical models is a non-unique and heuristic procedure. A set of different, in fact non-equivalent approaches is known. In the talk some principles of the integral quantization method is presented. The simplest integral quantization procedure is based on decomposition of unity in the Hilbert state space. More sophisticated way of thinking in this direction is related to the so called Quantum Motion Algebras. One of the unique property of the integral quantization is a possibility to treat physical time on the same footing as the space coordinates. This allows for construction of the covariant quantum spacetime position observable. In this case, instead of the unitary time evolution, other operators, usually projection or POVM operators which map the space of initial states into the space of final states at each step of the evolution can be used. The quantum evolution itself is a stochastic process. This allows to treat time as a quantum observable in a~consistent, observer independent way, which is a very important and required feature to resolve some quantum paradoxes and the time problem in cosmology. Changing ‘’parameter time” into ‘’quantum observable time” seems to be a good step to combine relativity and quantum mechanics.

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