

Summary of Marcin Domagała's Ph.D. dissertation "Quantum model of massless Klein – Gordon field coupled to gravitation".

Dirac's quantization procedure is completely carried out in Ph.D. dissertation entitled "Quantum model of massless Klein – Gordon field coupled to gravitation". Model describing massless Klein–Gordon field coupled to gravitational field is constructed. This is the second, fully characterized model of quantum gravity with all local degrees of freedom presented in the literature . Starting with Kuchar–Romano formulation, we construct quantum Gauss, vector and scalar constraints operators. These constraints are then solved. The scalar product is defined on the resulting physical Hilbert space. We have found all quantum observables that commute with constraints operators. The founded form of Dirac's observables shows the existence of natural 1-parameter group of automorphisms. This property is then used to define dynamical evolution. Physical hamiltonian is also defined.

Next, equivalence of the model with theory defined by quantum states of gravitation without matter which solve vector constraints (but not scalar constraints) evolving with respect to physical hamiltonian. Loop quantum gravity is used to describe quantum states and operators of sourceless gravitational field. In particular regularization of new hamiltonian operator is given. At the end we propose new derivation of this constraint.