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Quantum-reduced loop gravity: New perspectives on the kinematics and dynamics

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We present a systematic approach to the kinematics of quantum-reduced loop gravity, a model originally proposed by Alesci and Cianfrani as an attempt to probe the physical implications of loop quantum gravity. In order to implement the quantum gauge-fixing procedure underlying quantum-reduced loop gravity, we introduce a master constraint operator on the kinematical Hilbert space of loop quantum gravity, representing a set of gauge conditions which classically constrain the densitized triad to be diagonal. On one hand, the standard Hilbert space of quantum-reduced loop gravity can be recovered as a space of solutions of the master constraint operator, while on the other hand the master constraint approach provides a useful starting point for considering various possible generalizations of the standard construction. We also examine the dynamics of certain simple quantum states of geometry in the framework of quantum-reduced loop gravity. In particular, we show that the Hamiltonian which governs the dynamics of a state consisting of a single six-valent node bears a close formal resemblance to the Hamiltonian constraint of Bianchi I models in loop quantum cosmology.

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