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Quantization of Constantly Curved Tetrahedron

Monday 6 May 2024 17:00 (15 minutes)

In this talk, we develop a quantum theory of homogeneously curved tetrahedron geometry, by applying the combinatorial quantization to the phase space of tetrahedron shapes defined in arXiv:1506.03053. Our method is based on the relation between this phase space and the moduli space of SU(2) flat connections on a 4-punctured sphere. The quantization results in the physical Hilbert space as the solution of the quantum closure constraint, which quantizes the classical closure condition M4M3M2M1=1, Mv∈ SU(2), for the homogeneously curved tetrahedron. The quantum group Uq(su(2)) emerges as the gauge symmetry of a quantum tetrahedron. The physical Hilbert space of the quantum tetrahedron coincides with the Hilbert space of 4-valent intertwiners of Uq(su(2)). In addition, we define the area operators quantizing the face areas of the tetrahedron and compute the spectrum. The resulting spectrum is consistent with the usual Loop-Quantum-Gravity area spectrum in the large spin regime but is different for small spins. This work closely relates to 3+1 dimensional Loop Quantum Gravity in presence of cosmological constant and provides a justification for the emergence of quantum group in the theory.

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