FROM GROUPS AND KNOTS TO BLACK HOLE ENTROPY – MATHEMATICAL ASPECTS OF LOOP QUANTUM GRAVITY

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I will survey the formalism and main results of loop quantum gravity [1, 2] from a mathematical perspective. Then I take a closer look at the way black hole horizons are treated in the theory, by coupling a Chern-Simons theory on the horizon to the bulk degrees of freedom [3]. I will present some recent results on a new way to solve the self-duality equation involved directly in the quantum theory [4].

Keywords: quantum gravity, black holes, measures on spaces of connections, TQFT, Duflo isomorphism

[1] A. Ashtekar and J. Lewandowski, "Background independent quantum gravity: A Status report," Class. Quant. Grav. **21** (2004) R53 [gr-qc/0404018].

[2] A. Perez, "The Spin Foam Approach to Quantum Gravity," arXiv:1205.2019 [gr-qc], to appear in L. Rev. Rel.

[3] J. Engle, A. Perez and K. Noui, "Black hole entropy and SU(2) Chern-Simons theory," Phys. Rev. Lett. **105** (2010) 031302 [arXiv:0905.3168 [gr-qc]].

[4] H. Sahlmann and T. Thiemann, "Chern-Simons expectation values and quantum horizons from LQG and the Duflo map," Phys. Rev. Lett. **108** (2012) 111303 [arXiv:1109.5793 [gr-qc]].