Seminarium geometrów

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Spectral Triples and Quantum Homogeneous Kähler Spaces

Abstract: The notion of a noncommutative Kähler structure was recently introduced as a framework in which to understand the metric aspects of Heckenberger and Kolb's remarkable covariant differential calculi over the cominiscule quantum flag manifolds. Many of the fundamental results of classical Kähler geometry are shown to follow from the existence of such a structure, allowing for the definition of noncommutative Lefschetz, Hodge, Dolbeault-Dirac, and Laplace operators. In this talk we will discuss how a Kähler structure can be used to complete a calculus to a Hilbert space, and show that when the calculus is of so called ladder type, the holomorphic and anti-holomorphic Dolbeault–Dirac operators give spectral triples. Moreover, we show how Euler characteristics can be used to calculate the indexes of the Dirac operators, presenting the possibility of doing index calculations using noncommutative generalisations of classical vanishing theorems. The general theory will be applied to quantum projective space where a direct noncommutative generalisation of the Kodaira vanishing theorem allows us to show that both Dirac operators have non-zero index. Time permitting, we will show how full Hilbert C*-modules can also be constructed from a Kähler structure, and discuss conjectured examples from the B and D-series quantum groups, namely the odd and even dimensional quantum quadrics. (Joint with B. Das and P. Somberg)