University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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MSc (Georg-August-Universität Göttingen, 2014)
BSc (Westfälische Wilhelms-Universität Münster, 2011)

"Poincaré self-duality of A_θ"

Department of Mathematics and Statistics

Tuesday, March 17, 2020
8:30 A.M.
Clearihue Building
Room B007

Supervisory Committee:
Dr. Marcelo Laca, Department of Mathematics and Statistics, University of Victoria (Co-Supervisor)
Dr. Heath Emerson, Department of Mathematics and Statistics, UVic (Co-Supervisor)
Dr. Ian Putnam, Department of Mathematics and Statistics (Member)
Dr. Julio Navarro, Department of Physics and Astronomy, UVic (Outside Member)

External Examiner:
Dr. Bram Mesland, Mathematisch Instituut, Leiden University

Chair of Oral Examination:
Dr. Daniel Bub, Department of Psychology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

The irrational rotation algebra A_θ is known to be Poincaré self-dual in the KK-theoretic sense. The spectral triple representing the required K-homology fundamental class was constructed by Connes out of the Dolbeault operator on the 2-torus, but so far, there has not been an explicit description of the dual element. We will geometrically construct, for any non-trivial element g of the unimodular group, a finitely generated projective module L_g over $A_\theta \otimes A_\theta$ out of a pair of transverse Kronecker fows on the 2-torus. For upper triangular g, we will find an unbounded cycle representing the dual of said module under Kasparov product with Connes' class, and prove that this cycle is invertible in $\mathrm{KK}(A_\theta, A_\theta)$, allowing us to 'untwist' L_g to an unbounded cycle representing the unit for the self-duality of A_θ.