

University of New Brunswick

DEPARTMENT OF MATHEMATICS & STATISTICS

NOTICE OF MINI-COURSE

(5 Lectures for the Centre for Noncommutative Geometry and Topology)

Dr. Piotr M. Hajac

of

University of Warsaw and IMPAN

will speak on

**Principal Coactions of Discrete Groups
and K-Theory of Noncommutative Line Bundles**

Lectures are 1:30 to 2:20 PM in Tilley Hall on the following dates:

- September 26 – Monday – Room 309
- September 27 – Tuesday – Room 104
- September 28 – Wednesday – Room 309
- September 29 – Thursday – Room 104
- September 30 – Friday – Room 309

ABSTRACT

This mini course will begin with a succinct but self-contained review of fundamentals of Hopf-Galois theory, which describes the algebraic backbone of compact quantum principal bundles. This theory will be instantiated by principal coactions of discrete groups, which are tantamount to strong gradings of algebras. The Pontryagin dual of a discrete group is a compact quantum group, so that the thus graded unital algebras can be viewed as noncommutative compact principal bundles. Each direct summand appearing in the grading is a finitely generated projective module over the neutral-element grade subalgebra. These modules play a role of noncommutative associated line bundles.

It will be shown that such finitely generated projective modules are stably free if and only if a certain matrix with coefficients in the strongly graded algebra is invertible. This theorem will allow us to use K-theory to prove that the tautological line bundle over any quantum real projective space (given as a graph C^* -algebra by Hong and Szymanski) is not stably free and generates torsion in the K_0 group of the projective space. Another application of K-theory tools, will prove a similar result for certain natural noncommutative line bundles over the Heegaard quantum lens spaces. Other examples might be explained time permitting.

Dr. Piotr Hajac is an associate professor at the University of Warsaw and IMPAN.