University of Victoria | Graduate Studies

PROGRAMME

The Final Oral Examination
for the Degree of

DOCTOR OF PHILOSOPHY
(Department of Mathematics and Statistics)

Magdalena Georgescu

2006	University of Waterloo	MMath
2003	University of Waterloo	BMath

"Spectral Flow in Semifinite von Neumann Algebras"

Tuesday, November, 5, 2013
9:30 AM
University Centre, room A207a

Supervisory Committee:
Dr. John Phillips, Department of Mathematics and Statistics, UVic (Supervisor)
Dr. Marcelo Laca, Department of Mathematics and Statistics, UVic (Member)
Dr. Ian Putnam, Department of Mathematics and Statistics, UVic (Member)
Dr. Ahmed Sourour, Department of Mathematics and Statistics, UVic (Member)
Dr. Michel Lefebvre, Department of Physics and Astronomy, UVic (Outside Member)

External Examiner:
Dr. Masoud Khalkhali, Department of Mathematics, University of Western Ontario

Chair of Oral Examination:
Dr. Ned Djilali, Department of Mechanical Engineering, UVic

Abstract

Spectral flow, in its simplest incarnation, counts the net number of eigenvalues which change sign as one traverses a path of self-adjoint Fredholm operators in the set of of bounded operators $\mathcal{B}(\mathcal{H})$ on a Hilbert space. A generalization of this idea changes the setting to a semifinite von Neumann algebra $\mathcal{N}$ and uses the trace τ to measure the amount of spectrum which changes from negative to positive along a path; the operators are still self-adjoint, but the Fredholm requirement is replaced by its von Neumann algebras counterpart, Breuer-Fredholm.

Our work is ensconced in this semifinite von Neumann algebra setting. We prove a uniqueness result in the case when $\mathcal{N}$ is a factor. In the case when the operators under consideration are bounded perturbations of a fixed unbounded operator with τ-compact resolvents, we give a different proof of a p-summable integral formula which calculates spectral flow, and fill in some of the gaps in the proof that spectral flow can be viewed as an intersection number if $\mathcal{N} = \mathcal{B}(\mathcal{H})$.

Awards, Scholarships, Fellowships

- 2008 - 2009 University of Victoria Fellowship, *University of Victoria*
- 2007 - 2008 Pacific Century Graduate Fellowship, *University of Victoria*
- 2005 - 2006 University of Waterloo Graduate Scholarship, *University of Waterloo*
- 2005 - A.S.A. Wyatt Award in Pure Mathematics, *University of Waterloo*
- 2005 - UW/NSERC Graduate Scholarship, *University of Waterloo*

Presentations

1. Georgescu, Magdalena and John Phillips
   "Spectral Flow in Semifinite von Neumann Algebras", Canadian Operator Symposium, Kingston, Ontario, Canada. 2012 (oral)

2. Georgescu, Magdalena and John Phillips
   "Integral Formulas for Spectral Flow", Northwest Functional Analysis Seminar, Banff, Alberta, Canada. 2012 (oral)