



University
of Victoria

Graduate Studies

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

of

MARK PIRAINO

MS (DePaul University, 2015)

BS (DePaul University, 2014)

“Matrix Gibbs States, Factor Maps and Transfer Operators”

Department of Mathematics and Statistics

Monday, June 24, 2019

11:00 A.M.

Clearihue Building

Room B017

Supervisory Committee:

Dr. Chris Bose, Department of Mathematics and Statistics, University of Victoria (Co-Supervisor)

Dr. Anthony Quas, Department of Mathematics and Statistics, UVic (Co-Supervisor)

Dr. Pavel Kovtun, Department of Physics and Astronomy, UVic (Outside Member)

External Examiner:

Dr. Jairo Bochi, Facultad de Matemáticas, Pontificia Universidad Católica de Chile

Chair of Oral Examination:

Dr. Charlotte Loppie, School of Public Health & Social Policy, UVic

Abstract

We study two problems. The first concerning ergodic properties of measures on $\Sigma^{\mathbb{Z}}$ such that $\mu_{A,t}[x_0 \cdots x_{n-1}] \approx e^{-nP} \|A_{x_0} \cdots A_{x_{n-1}}\|^t$ where $A = (A_0, \dots, A_{M-1})$ is a collection of matrices, such measures are known as matrix Gibbs states. In particular we give a sufficient condition for $\mu_{A,t}$ to be isomorphic to a Bernoulli shift and mix at an exponential rate. The second problem concerns factors of Gibbs states. In particular we show that all of classical uniqueness regimes for Gibbs states are closed under factor maps which satisfy a mixing in fibers condition. The unifying approach to both of these problems is to realize the measure of cylinder sets in terms of positive operators.