



University
of Victoria

Graduate Studies

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

of

DINA BURIC

MSc (Western Washington University, 2012)

BSc (Western Washington University, 2010)

“Splitting Factor Maps into s - and u -bijective Maps”

Department of Mathematics and Statistics

Wednesday, December 1, 2021

11:00 A.M.

Conducted Virtually

Supervisory Committee:

Dr. Ian Putnam, Department of Mathematics and Statistics, University of Victoria (Supervisor)

Dr. Marcelo Laca, Department of Mathematics and Statistics, UVic (Member)

Dr. Heath Emerson, Department of Mathematics and Statistics, UVic (Member)

Dr. Sara Ellison, Department of Physics and Astronomy, UVic (Outside Member)

External Examiner:

Dr. Jayadev Athreya, Department of Mathematics, University of Washington

Chair of Oral Examination:

Dr. Ke Xu, Department of Economics, UVic

Abstract

We model hyperbolic toral automorphisms by two types of Smale spaces; shifts of finite type and substitution tilings spaces. Smale spaces are dynamical systems with local hyperbolic product structure. In 1970, Bowen showed that an irreducible Smale space is a factor of a shift of finite type by showing that it has Markov partitions. Putnam extended Bowen's theorem by showing that every irreducible Smale space has a factor map that can be split into a s -bijective and u -bijective map; thereby better modelling a Smale space on its characterizing expanding and contracting spaces separately. In this thesis, we define two new constructions of Markov partitions for hyperbolic toral automorphisms inspired by the work of Adler, Weiss, and Praggastis. With one of the constructions, we investigate when a factor map from a shift of finite type to a hyperbolic toral automorphism can be written as a composition of a s -bijective and u -bijective map and we show that if such a splitting exists then the Markov partition must satisfy a Border Continuity condition. The second construction can be thought of as an explicit example of Putnam's theorem for the case of hyperbolic toral automorphisms whose defining matrix is in dimension 2 and has positive entries. We define a full splitting for all such hyperbolic toral automorphisms with one exception; the Arnold Cat map.