

# Applied Topology in Albany (ATiA) Seminar

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ABSTRACT. In this talk, I review recent collaborative work with Robert Ghrist on laying the foundation for a homological Hodge theory of cellular sheaves of lattices, rightfully dubbed “Tarski sheaves.” This work is motivated by recent efforts by Ghrist and Hansen to lift spectral graph theory to sheaves, capitalizing on the Hodge decomposition of the cochain complex of a familiar cellular sheaf (of inner-product spaces). One goal of my research is to study more familiar sheaves such as sheaves of vector spaces or sheaves of sets by categorifying them. Lattice theory is a tactile playground for doing category theory with an eye towards computation. I will present a lattice-theoretic analog of the Hodge Theorem which relates the fixed points of the Laplacian of a Tarski Sheaf: the Tarski Laplacian. This main result—and its issuing cohomology theory—relies heavily on the famous folk theorem often attributed to Tarski, the Tarski Fixed Point Theorem. Along the way, I will provide plenty of examples. Time permitting, I will share recent progress between myself, Ghrist and North on further categorifying the Hodge Theorem into a statement about sheaves of categories and their adjunctions.