Proposal Sample

Title – A Brief Look at Ergodic Theory and its Applications

Program of Study – Mathematics

Presentation Type – Choose one of the following: PowerPoint

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Category – Choose one of the following: Textual.

Abstract: This paper gives a brief introduction to the theory behind and applications of ergodic theory. Ergodic theory is a broadly defined branch of mathematical research that is designed to give a formalization of the movements of particles within various topological spaces. However, unlike classical mechanics, which is designed to give an exact measurement of the location of a particle or particles, ergodic theory looks at the movements of particles over long periods of time, defining a patterning of said movements after an arbitrary amount of time. This branch of mathematics finds its origin in the realm of statistical physics, where certain systems cannot be described directly due to the inability of scientists to properly measure the individual components of these systems. The paper will begin with a look at the origins of ergodic theory. This section will examine the problems in physics that ergodic theory was originally meant to address and will look at some of the concepts that ergodic theory inherits from functional analysis, the branch of mathematics that ergodic theory is derived from. Then a summary of the basic tenets and theorems of ergodic theory will be provided. This section will give a summary of the requirements that a functional space must meet in order to be considered ergodic, and it will also look at the theorems regarding ergodic space that makes the study of such spaces useful. Finally, a series of examples of the applications of ergodic theory will be provided, including examples from the realms of physics, mathematical biology, and probability theory.

Christian worldview integration: As a Christian, I believe that "God is not a God of disorder…" Because of this fact, I believe that everything in the universe has a logical structure to it, including things that seem random, such as the movements of subatomic particles or the patterns of physical systems. As a result of this, I tend to have a deep appreciation for the patterns that exist in God's world. I believe that things that others consider trivial, such as graphs or patterns within numerical systems, are actually a representation of the character of God, and I enjoy seeing His hand at work in seemingly random patterns. Additionally, I also believe that these patterns are perfectly valid for modeling the world that we live in. I believe that everything happens in an orderly way as ordained by God, even seemingly trivial things such as the rolling of a die (Proverbs 16:33). Therefore, I believe that deriving models for the patterns we see in the universe helps us to understand it better and, as a result, helps us to better understand the Creator of this universe. In relation to this, I also believe that we, as those created in God's image, ought to understand as much as possible about the world that God has created, and ergodic theory gives us a basis for understanding systems that scientists have yet to fully analyze, including different physical systems and the movements of microscopic lifeforms. Because of this, I believe that ergodic theory is an extremely useful branch of study, and I hope to be able to present its beauty to my audience.