

CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) **Project Number** Jared A. Tramontano 34760 **Project Title** On the Theory of Lures with Dynamical Action on Compa Topological Manifolds and Ordinary Hyperreal Fractal Strings **Abstract** Objectives/Goals In this project, we attempt to provide a new notion of a topological homeomorphism terms of a dynamical system. That is, we want to construct a time-dependent quasi-attractor and a time-dependent basin of attraction that respects the homotopy equivalence class of some compact topological manifold by acting on some portion of the manifolds and indary, while altering the Minkowski Content. Methods/Materials There is no distinct set of steps one must follow in order to do research in mathematics. The "lure" was constructed through trial and error; various possible definitions were tested. For example, we originally constructed a one-dimensional definition that was not easily generalized to higher dimensions, so we had to revise said definition. As far as materials are concerned, the only materials used were textbooks and scholarly articles on related subjects. Results We were able to properly provide a new notion of a topological hymeomorphism in terms of a dynamical system, namely a "lure". This definition is constructed for general n-dimensions. We are able to show that, with respect to the monoid of positive time under addition, a set M denoting the homotopy equivalence class of a manifold, and the "lure" this system satisfies the axioms of a dynamical system. However, we are able to generalize this notion beyond that of compact topological manifolds, to ordinary hyperreal fractal strings. That is, the natural hyperreal extension of an ordinary fractal string, the first appearance of such an object. **Conclusions/Discussion** In future work, we would like to apply the seneral itea of a "lure" to practical applications in economic systems, biological systems, and certain machine learning algorithms. Additionally, we would like to extend the notion of a lure to more general manifolds, as well as Iterated Function Systems Summary Statement tion of a topological homemorphism in terms of a dynamical system. Help Received I'd like to thank Dr. Michael Maroun for his direct supervision and guidance, Dr. Michael Lapidus for his support, and Colin Aitken of MIT for his discussions on the subject.