Abstract Submitted
for the FWS19 Meeting of
The American Physical Society

Investigating the existence of dynamical chaos in stellar evolution[1] BJORN LARSEN, NICK NELSON, California State University Chico
— Stellar evolution is a highly modeled area of stellar astrophysics with numerous applications. The systems of equations used to effectively model stellar evolution are highly nonlinear, and thus potentially chaotic. Chaotic behavior is an as-yet unquantified source of uncertainty in these models. We test for chaotic behavior by comparing the differences in phase space between two nearly-identical sun-like stellar simulations over their main sequence evolution. We run this test for stars of different initial masses and rotation velocities, with results showing exponential growth across multiple orders of magnitude of phase space separation over time for the majority of rotating models, and a spread of lyapunov times ranging from approximately 100 million to 5 billion years. We also analyze how chaos drives growth in uncertainty in observable star properties including effective temperature and radius with initial uncertainties on the order of 10-9 increasing to as high as 10-3.

[1]Chico STEM Communications Collaborative

Bjorn Larsen
California State University Chico

Date submitted: 07 Oct 2019

Electronic form version 1.4