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STELLAR GENETICS: USING STELLAR SUNSPOT ANALOGS TO REVEAL THE EVOLUTION AND FUTURE OF OUR SUN

Abstract

Understanding the evolution of our Sun is essential to life on earth as well as life elsewhere. Sun spots provide unique insight into the disposition of our stellar partner, however only recently has data existed which reveals their correlation with the age and composition of distant stars. Kepler data allows researchers to look back in time and analyze the history of sun spots at various phases of stellar evolution and compare that data with observations made in our own Solar System. Predicting the magneto hydrodynamics of Sun-like stars will advance research on the fundamental parameters affecting stellar dynamic enabling more accurate predictions of solar weather. These predictions can help researchers pinpoint suitable habitable zones.

Starhunter Corporation has analyzed fluctuations in stellar luminosity from an immense range of solar analogs (Type G) to present a comprehensive snap shot of evolution as it relates to sun spots. A custom Python code utilizing discrete Fourier Transform (DFT) on normalized data sets, as well as filtering out objects with very short term variability, or with poor S/N ratios was developed to identify candidate stars with a marked beat frequency indicative of differential rotation.

To ensure that the periodic behavior of the candidate stars is indeed arising from the presence of starspots, the StarSpotz program9 will be used (Croll B. et al. 2006), (Croll, B. 2006). The program makes use of a Marquardt] Levenberg damped least] squares algorithm in order to fit the data according to specific models (Budding 1977; Dorren 1987). It then uses a Markov chain Monte Carlo method to compute the most likely arrangement of spots, including the latitudes of the starspots, respective periods of rotation, and the coefficient of differential rotation. The rotational coefficients obtained will then be compared to those observed on the Sun.

An accurate magneto hydrodynamic model of solar systems will assist the search for extra-terrestrial life by narrowing the scope of potential targets. Only through correlation between sun spots and the magnetic field of the parent star can researchers gauge the level of penetrating solar radiation that may not only initiate life processes but destroy them as well.