Stellar Heartbeats: Mapping Activity Cycles of Sun-like Stars in Support of Future Exoplanet Science

Transmission spectroscopy is one of the most powerful techniques for probing the atmospheres of extrasolar planets and searching for potential biosignatures. However, these measurements typically have extremely low signal-to-noise ratios and are strongly affected by variability in the host star. Stellar activity such as spots and faculae can imprint spectral features that mimic or obscure biological signatures, leading to false detections or incorrect interpretations (e.g., Rackham et al. 2018, Astrophysical Journal, 853, 122). One obvious mitigation strategy is to schedule observations during periods of minimal stellar activity. This requires prior knowledge of the host star's activity cycle, similar to the Sun's well-known 11-year solar cycle. As the exoplanet community prepares to search for signs of life on terrestrial planets orbiting Sun-like stars, a critical gap persists: the magnetic activity cycles of most of these host stars are not yet well determined.

This project aims to use consistent long-baseline archival photometric observations (e.g. ATLAS) to measure activity cycle periods of solar-like stars and create a small database of stellar cycle lengths. This will contribute toward improving the planning and interpretation of future transmission spectroscopy observations of Earth-like exoplanets.

The strategy will obtain archival photometric light curves from public databases. Prioritising solar-type stars (spectral types F, G, and early K), long-term brightness variations associated with magnetic activity cycles will be extracted using time-series analysis techniques such as Lomb-Scargle periodograms and long-baseline trend analysis. The derived cycle periods will be compared with solar values and published results where available.

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