A Flexible Model for Investigating the Properties of Starspots: Comparison of Model Predictions to Observed Data

Accurate age estimates provide a wealth of information on various astrophysical processes, such as giant planet formation timescales. However, accurate age estimates remain elusive. Properties predicted by stellar evolution models frequently diverge from the measured properties of real stars, especially when considering cool, late-type stars. There is speculation that starspots – typically unaccounted for in theoretical predictions – may explain the discrepancies between model predictions and observations. To examine the impact of starspots on observed stellar properties, we use a flexible starspot model to generate stellar evolution isochrones that account for the effects of starspots. These new isochrones are then compared against photometric data for the Pleiades and Praesepe open clusters. Three unique classes of starspot models are used to explore the impact of the assumed starspot formation mechanism. We demonstrate that one class of models are inconsistent with the observed data, placing constraints on the depth at which starspots form within a star. Two classes of models are able to reproduce the observed photometric data, with both exhibiting starspot temperatures consistent with expected values, but requiring different surface coverages. Further work will focus on diminishing the effects of observational bias and testing additional observational properties. These efforts will allow us to determine the viability of the remaining starspot models and further examine the question of how starspot formation mechanisms affect stellar structure.