Testing the detectability of rotation and differential rotation signals in Kepler light curves

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Abstract

Kepler and CoRoT have opened up a new era in the study of stellar surface rotation and differential rotation using the rotational modulation of star spots. Over the past couple of years several studies have reported not only period measurements, but also differential rotation, for tens of thousands of stars. The implications of these studies are potentially very far reaching, but it is important to establish how robust the measurements are, and what limits their accuracy. In particular, the evolution of active regions can reproduce many of the light curve features often associated with differential rotation.
I will report on the results of a blind exercise aiming to address these questions by asking many of the teams active in rotation and differential rotation measurements - to apply their methods to over 1000 simulated light curves, consiting of realistic spotted star signals (including activity cycles, spot evolution and, in some cases, differential rotation) injected into Kepler light curves of very quiet stars (containing little or no evidence of stellar variability). Also included were a noise-free, idealised set (to distinguish between fundamental and noise-related issues) and a examples drawn from solar total irradiance data. While the results are very encouraging for "mean" period measurements, differential rotation proves more tricky to measure reliably, as expected.
I will also discuss plans for future, improved tests of this kind, including more reaslistic physical models, and testing the light curve detrending steps which are a key preliminary to any rotation study.

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