Dynamic Black-Level Correction and Artifact Flagging in the Kepler Data Pipeline

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Instrument-induced artifacts in the raw Kepler pixel data include time-varying crosstalk from the fine guidance sensor (FGS) clock signals, manifestations of drifting moiré pattern as locally correlated nonstationary noise and rolling bands in the images which find their way into the calibrated pixel time series and ultimately into the calibrated target flux time series. Using a combination of raw science pixel data, full frame images, reverse-clocked pixel data and ancillary temperature data the Keplerpipeline models and removes the FGS crosstalk artifacts by dynamically adjusting the black level correction. By examining the residuals to the model fits, the pipeline detects and flags spatial regions and time intervals of strong time-varying black-level (rolling bands) on a per row per cadence basis. These flags are made available to downstream users of the data since the uncorrected rolling band artifacts could complicate processing or lead to misinterpretation of instrument behavior as stellar. This model fitting and artifact flagging is performed within the new stand-alone pipeline model called Dynablack. We discuss the implementation of Dynablack in the Kepler data pipeline and present results regarding the improvement in calibrated pixels and the expected improvement in cotrending performances as a result of including FGS corrections in the calibration. We also discuss the effectiveness of the rolling band flagging for downstream users and illustrate with some affected light curves.