YOU DON’T NEED TO DETREND YOUR DATA

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likelihood function

\[ p(\text{data} \mid \text{model}) = \mathcal{N}[f; \mu(\theta), \Sigma(\alpha)] \]

- **observations** includes:
  - “raw” photometry
  - auxiliary measurements (optional)
- **model** includes:
  - physics (Kepler’s equation, N-body, etc.)
  - geometry (limb darkening, etc.)
- **covariance** includes:
  - observational uncertainties
  - systematics (trends, discontinuities, etc.)

a generalization of standard \( \chi^2 \) likelihood

explicit sparsity

SuiteSparse\(^1\)
state-of-the-art sparse linear algebra

computationally tractable

George\(^2\)
an open source implementation

search is the process of mining light curves for new candidates. Writing this question as a hypothesis test lets us incorporate a better likelihood function and search without median filtering the data. We find: Kepler is sensitive to Earth-analog transits!

anywhere that one might use a \( \chi^2 \) likelihood function, this Gaussian process is a drop-in replacement. For characterizing planet candidates, all we need to do is trivially update the computation of the probability function in the MCMC loop. It’s even easy to marginalize the kernel parameters!

check out code.dfm.io for open source code and demos

1. cise.ufl.edu/research/sparse/SuiteSparse
2. github.com/dfm/george