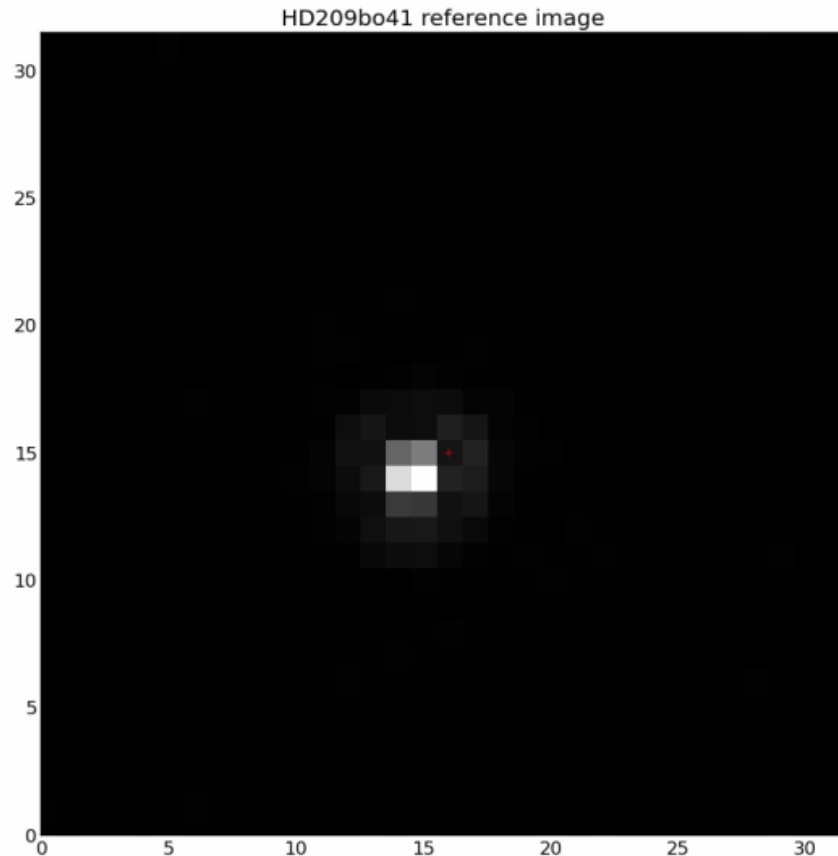


Exoplanet Data Reduction Tool

Hannah Diamond-Lowe & Zakir Gowani

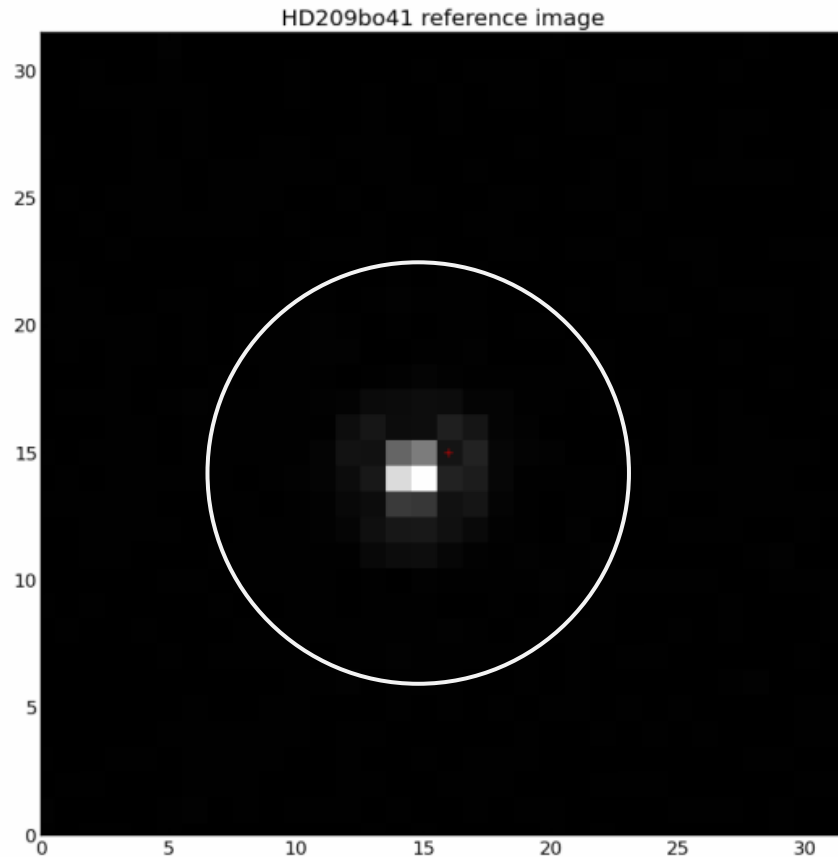
Overview

- Determine best aperture size to use
- Quick, efficient method for guessing boundaries



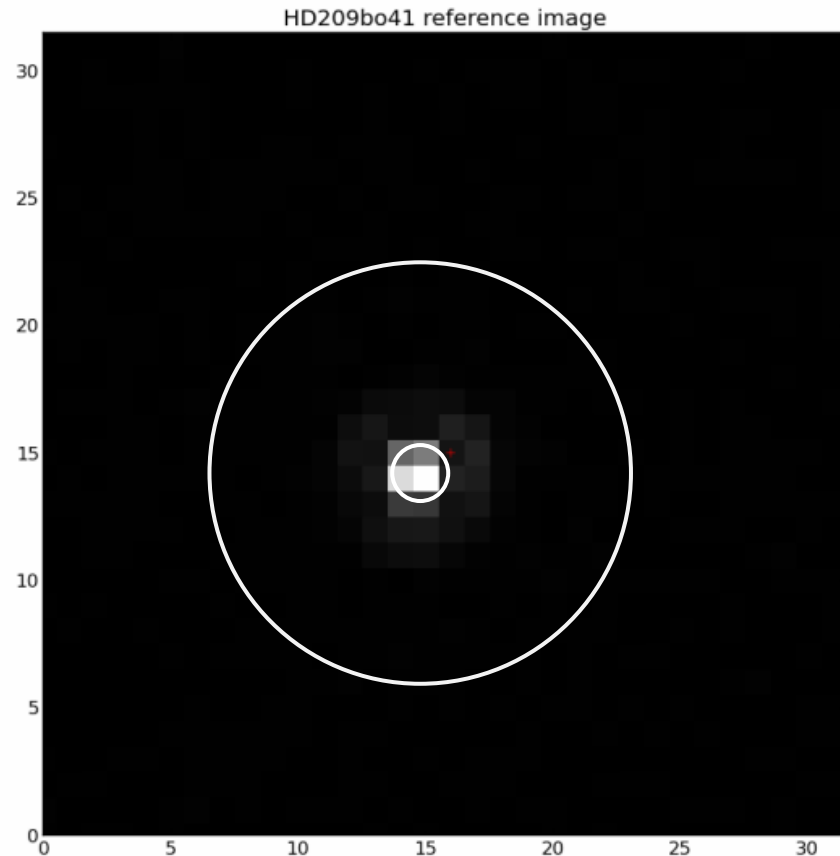
Motivation

- Too large = too much noise



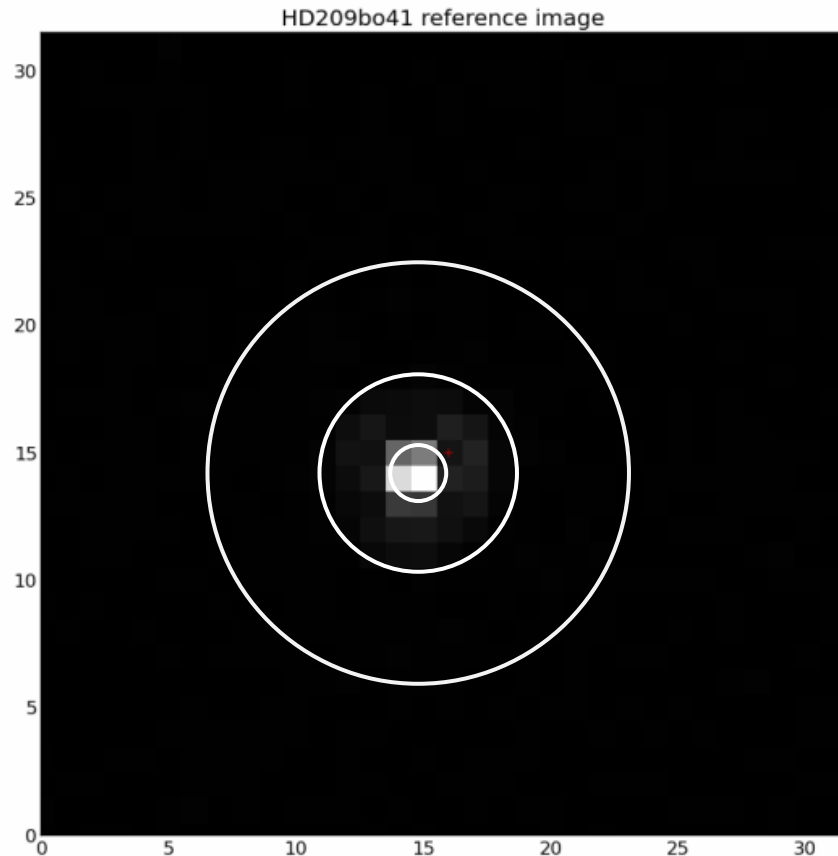
Motivation

- Too small = loss of information



Motivation

- Just right = the most information with the least amount of background noise
- If this step is not done properly the whole analysis will be wrong



Problem

- Finding the best aperture is lengthy and time consuming
- The best solution will provide a guess range
- Solution example: best aperture from 3 - 4 pixels in radius

Raw Data

- FITS files (pictures)
- 64 data frames per FITS file
- ~4 - 8GB per dataset

0 13.0 1.0 20.0 20.0 0.0 19.0 10.0 23.0 13.0 22.0 10.0 12.0 31.0 12.0 19.0 -0.0 -1399.0 12.0
.0 17.0 29.0 21.0 30.0 25.0 18.0 17.0 23.0 17.0 15.0 6.0 30.0 29.0 26.0 11.0 9.0 7.0 27.0 8.0
19.0 9.0 26.0 28.0 13.0 17.0 11.0 13.0 26.0 20.0 20.0 8.0 33.0 10.0 31.0 16.0 11.0 17.0 -4.0
17.0 12.0 36.0 25.0 -7.0 35.0 38.0 20.0 38.0 34.0 16.0 27.0 31.0 33.0 14.0 37.0 16.0 17.0 25
16.0 19.0 24.0 68.0 21.0 25.0 18.0 44.0 49.0 33.0 31.0 14.0 33.0 26.0 21.0 28.0 19.0 16.0 14
17.0 11.0 25.0 26.0 15.0 29.0 41.0 73.0 79.0 54.0 35.0 8.0 37.0 17.0 25.0 18.0 13.0 10.0 26
24.0 38.0 46.0 33.0 34.0 31.0 43.0 70.0 96.0 53.0 36.0 32.0 25.0 11.0 40.0 23.0 37.0 44.0 1
15.0 14.0 14.0 15.0 23.0 53.0 69.0 454.0 756.0 136.0 51.0 42.0 34.0 30.0 18.0 2.0 9.0 6.0 18
2.0 23.0 19.0 27.0 32.0 67.0 135.0 1404.0 2788.0 550.0 108.0 60.0 23.0 37.0 34.0 12.0 17.0 21
19.0 27.0 25.0 34.0 31.0 49.0 530.0 4357.0 5854.0 1855.0 273.0 48.0 60.0 23.0 17.0 23.0 16.0
6.0 3.0 15.0 76.0 71.0 279.0 709.0 807.0 604.0 238.0 79.0 30.0 31.0 19.0 39.0 -2.0 9.0 2.0
28.0 16.0 27.0 0.0 19.0 87.0 88.0 66.0 89.0 78.0 45.0 40.0 45.0 15.0 27.0 18.0 27.0 14.0 17.0
.0 16.0 13.0 36.0 8.0 34.0 57.0 91.0 14.0 40.0 27.0 32.0 19.0 9.0 14.0 24.0 16.0 26.0 7.0 11
10.0 16.0 13.0 35.0 25.0 26.0 44.0 58.0 34.0 26.0 26.0 10.0 19.0 -1.0 22.0 0.0 15.0 -7.0 16.0
.0 22.0 16.0 25.0 38.0 8.0 28.0 40.0 15.0 12.0 37.0 26.0 29.0 12.0 -7.0 15.0 14.0 22.0 9.0 2
14.0 14.0 -1.0 24.0 22.0 24.0 26.0 29.0 29.0 28.0 9.0 15.0 26.0 25.0 -15.0 15.0 18.0 -4.0 1
-2.0 18.0 11.0 37.0 28.0 27.0 22.0 13.0 16.0 22.0 16.0 2.0 27.0 22.0 20.0 13.0 24.0 21.0 20.0
5.0 8.0 27.0 15.0 11.0 22.0 13.0 -3.0 29.0 29.0 12.0 30.0 27.0 19.0 14.0 28.0 25.0 14.0 6.0
15.0 13.0 20.0 12.0 24.0 16.0 26.0 16.0 18.0 23.0 11.0 26.0 30.0 2.0 21.0 7.0 16.0 26.0 6.0
0 -7.0 11.0 47.0 17.0 16.0 21.0 15.0 2.0 11.0 33.0 18.0 10.0 29.0 24.0 12.0 18.0 7.0 17.0 5.0
.0 20.0 4.0 18.0 17.0 11.0 4.0 34.0 10.0 16.0 4.0 -8.0 -7.0 -2.0 16.0 25.0 16.0 9.0 -8.0 38.0

Data Reduction

- Eliminate noise spikes
- Determine how much information to keep
- Test runtimes for 10 FITS files (~8000 in whole)

[illegible]

Data Reduction: Method A

- Determine the best aperture size for every data frame file
- Each thread contributes to analysis of single FITS file
- 64 data frames spread evenly across available threads
- Runtime for test: 288.1 s (extrapolate: 64.02 hr)

Data Reduction: Method B

- Determine the best aperture size for every data frame file
- Main thread obtains full list of FITS files and distributes whole FITS files to other threads
- Runtime for test: 430.0 s (extrapolate: 95.6 hr)

Data Reduction: Method C

- Determine the best aperture size per FITS file
- Create an averaged, composite data frame
- Good for data frames taken with short exposure times
- Runtime for test: 11.5 s (extrapolate: 2.6 hr)

Data Reduction: Method D

- Determine best aperture size for a sample of data frames in each FITS file
- Choose 4 out of 64 data frames per FITS file
- Good for data frames with long exposure times
- Runtime for test: 21.8 s (extrapolate: 4.84 hr)

And the winner is...

Method C!

- Fastest
- Inherently deals with short-timescale noise spikes

Results

