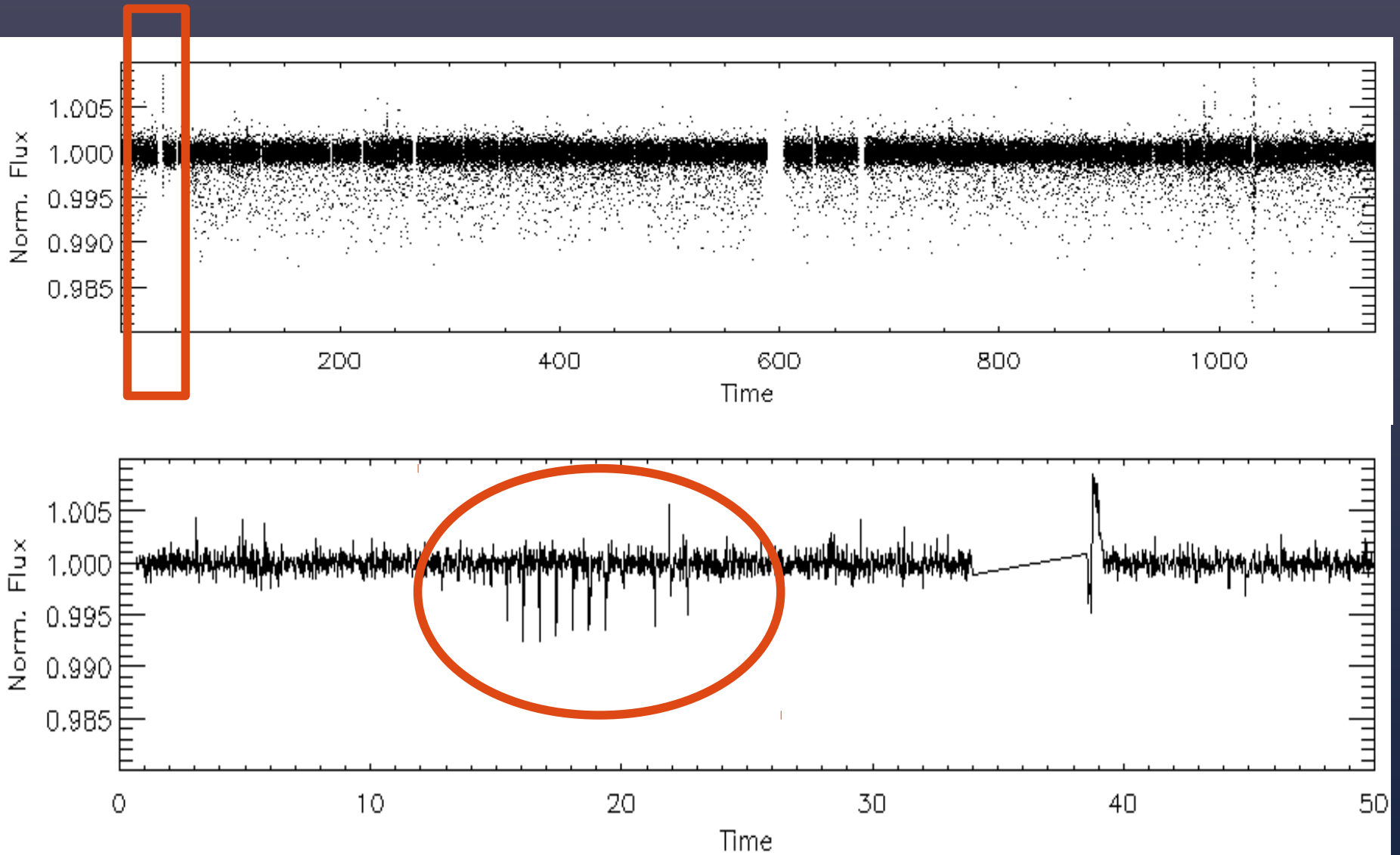# A search for disintegrating planets in the CoRoT light curves
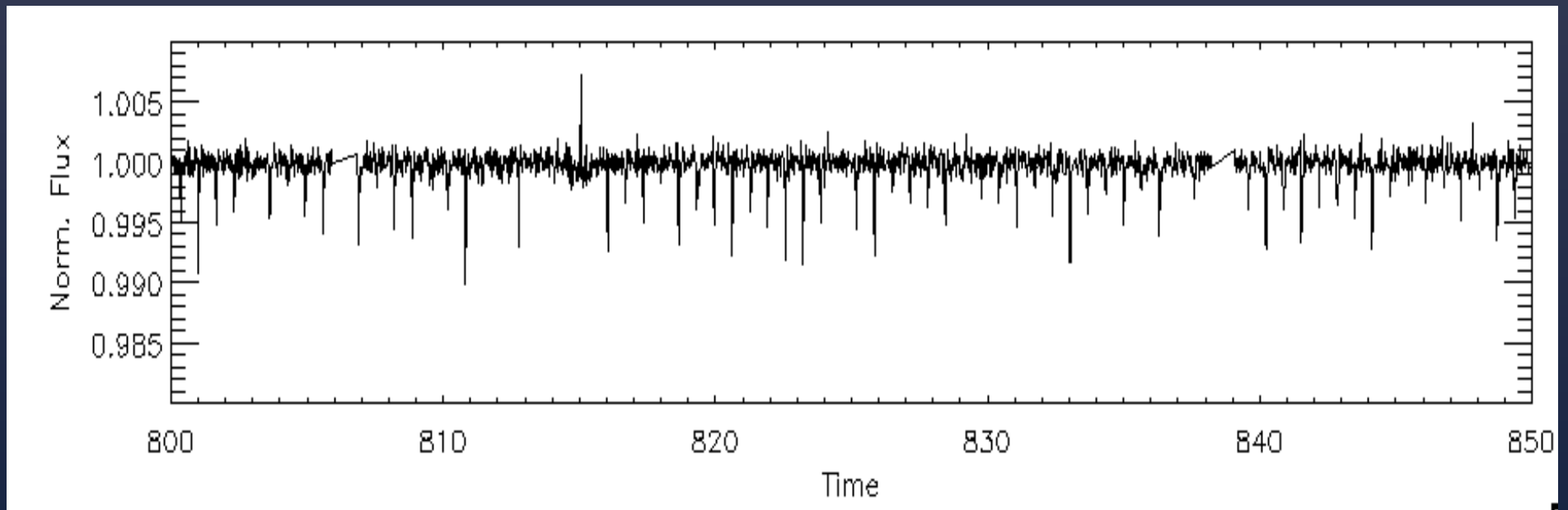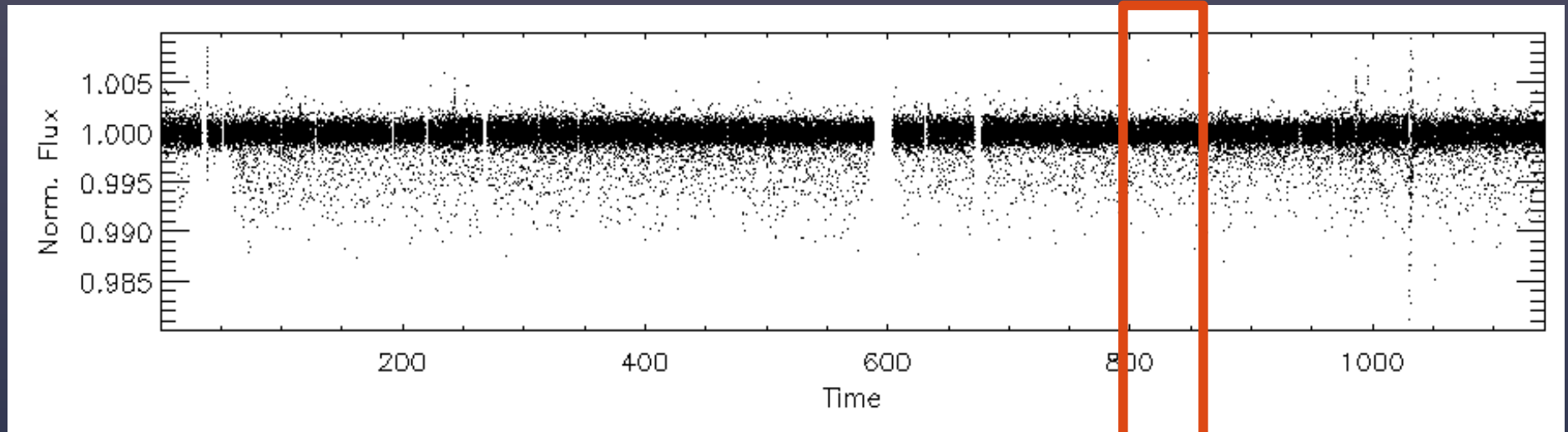
S. Hoyer[1], R. Alonso[2]

(1): Severo Ochoa Fellow
(2): Ramon y Cajal Fellow
Instituto de Astrofisica de Canarias
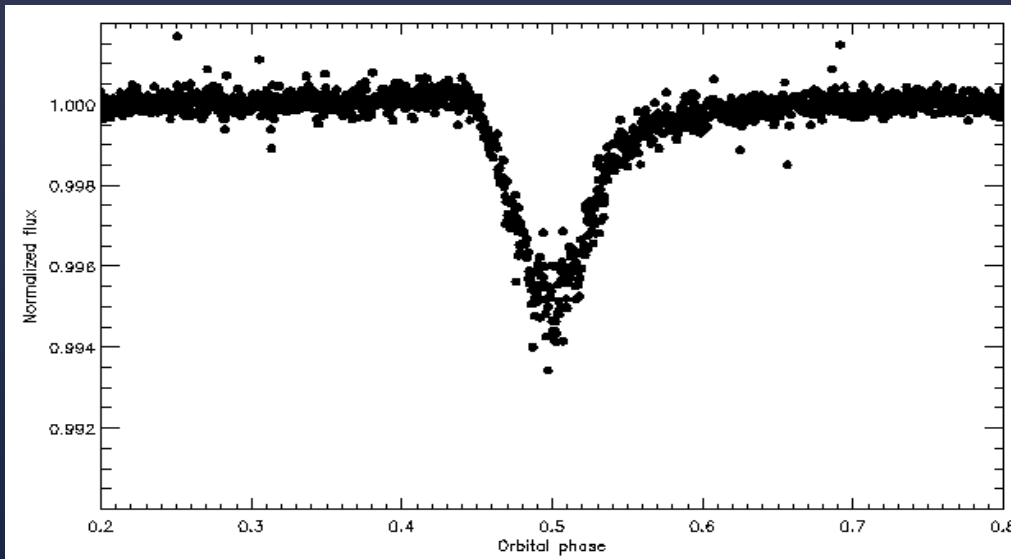Universidad de La Laguna

The KIC1255 Light Curve
(V = 16.2 mag)
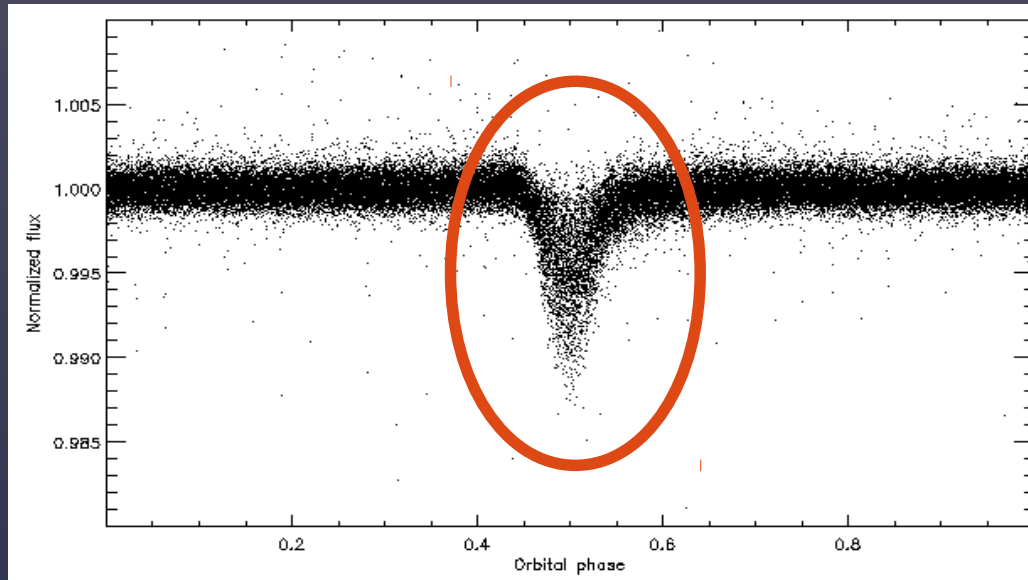
The KIC1255 Light Curve

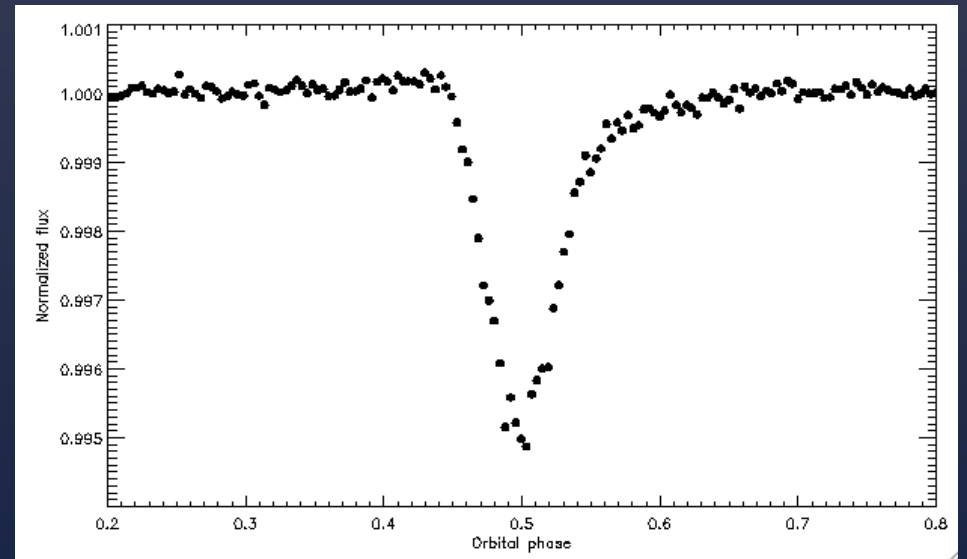
Not a KOI Object !!!

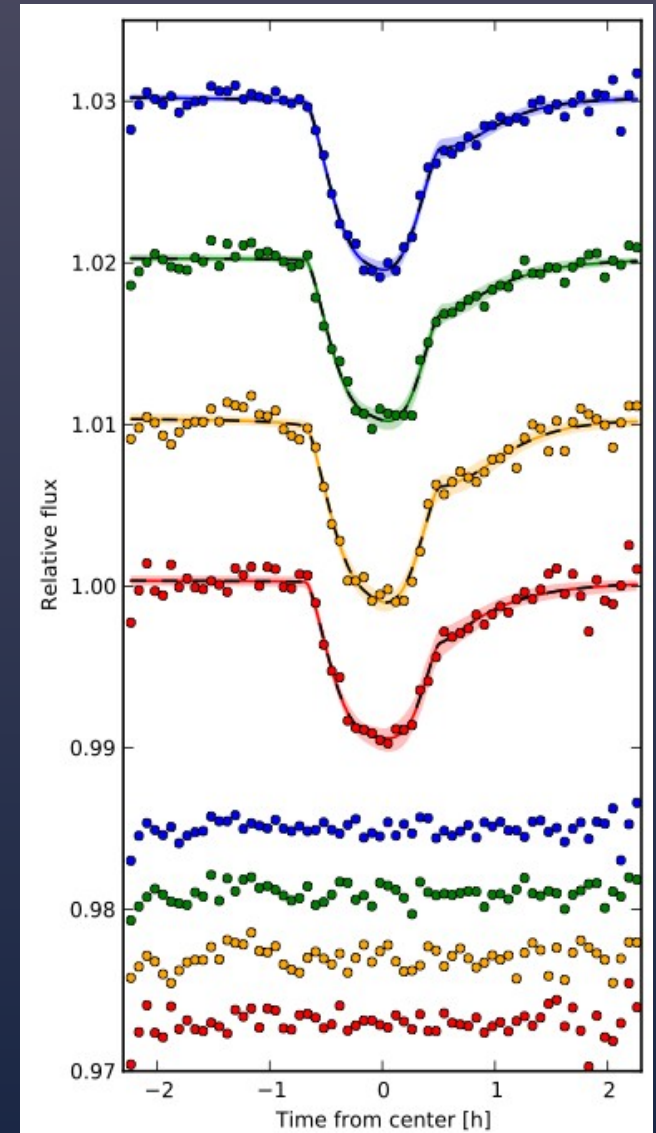# The Phase-folded Light Curve

Binning 20 points

Binning 200 points

Evidences

- Periodic dips:
    ~ 2 hours every 15 hours

- Variable depth:
    <0.005% – 1.2%

- Sudden changes, non periodical behavior

- Phase-folded light curve looks asymmetric

Alonso et al. in prep.

Possible scenarios one could imagine

- One transiting planet with orbital parameters changing due gravitational interactions

- Binary planets

- Background weird blended eclipsing binary

- Timescales should be longer than orbital period and no TTVs are detected.

- Not stable, should fill the Roche lobe

- Makes the problem more extreme and does not explain asymmetries in the eclipse shape

Most plausible scenario

POSSIBLE DISINTEGRATING SHORT-PERIOD SUPER-MERCURY ORBITING KIC 12557548

S. Rappaport[1], A. Levine[2], E. Chiang[3,4], I. El Mellah[1,5], J. Jenkins[6], B. Kalomeni[2,7,8], E. S. Kite[4,9],
M. Kotson[1], L. Nelson[10], L. Rousseau-Nepton[11], and K. Tran[1]

[1] 37-602B, M.I.T. Department of Physics and Kavli Institute for Astrophysics and Space Research, 70 Vassar St., Cambridge, MA 02139, USA; sar@mit.edu
[2] 37-575, M.I.T. Kavli Institute for Astrophysics and Space Research, 70 Vassar St., Cambridge, MA 02139, USA; aml@space.mit.edu
[3] Department of Astronomy, UC Berkeley, Hearst Field Annex B-20, Berkeley, CA 94720-3411, USA; echiang@astro.berkeley.edu

- Assumes a object of:

  $M = 0.1\ M\_earth$

  $Rp = 0.5\ R\_earth.$

- Absence of ellipsoidal light variations

  $\rightarrow M < 3\ M\_jupiter$

- It has the potential to probe the interior of rocky planets !! But the star is faint....

Are there similar objects in the CoRot data?

- Deeper transits are ~ 1.3% easily detectable also with CoRoT.

- About 160000 stars observed with CoRoT (comparable with the Kepler's numbers)

- Might have been unrecognized by detection teams, due to the peculiarity of the transits (is not a KOI: so it seems it was undetected by Kepler team)

First Approach: Fast and dirty search

- For each curve:
  - Select a window of 0.4 days
  - If there are more than 4 negative outliers (>3 sigma) perform a fit of a trapeze (depth, center, width). Save results.
  - Move the window 0.2 days and repeat operation
  - If there is a total of more than 10 events, compute the dispersion of the fit depths.
- Sort the curves by decreasing dispersion of fit depths.
- Most of the events are: EBs, pulsating stars, instrumental jumps.
- A few "KIC1255-like" features are inserted in random curves, to evaluate completeness of the search.
- Completed search of 160k stars, 19400 returned some dispersion of depths and were checked manually (12%). No candidates found.

First Approach: Results

All detected events out of 160k stars

Significance of 79 inserted KIC1255-like features
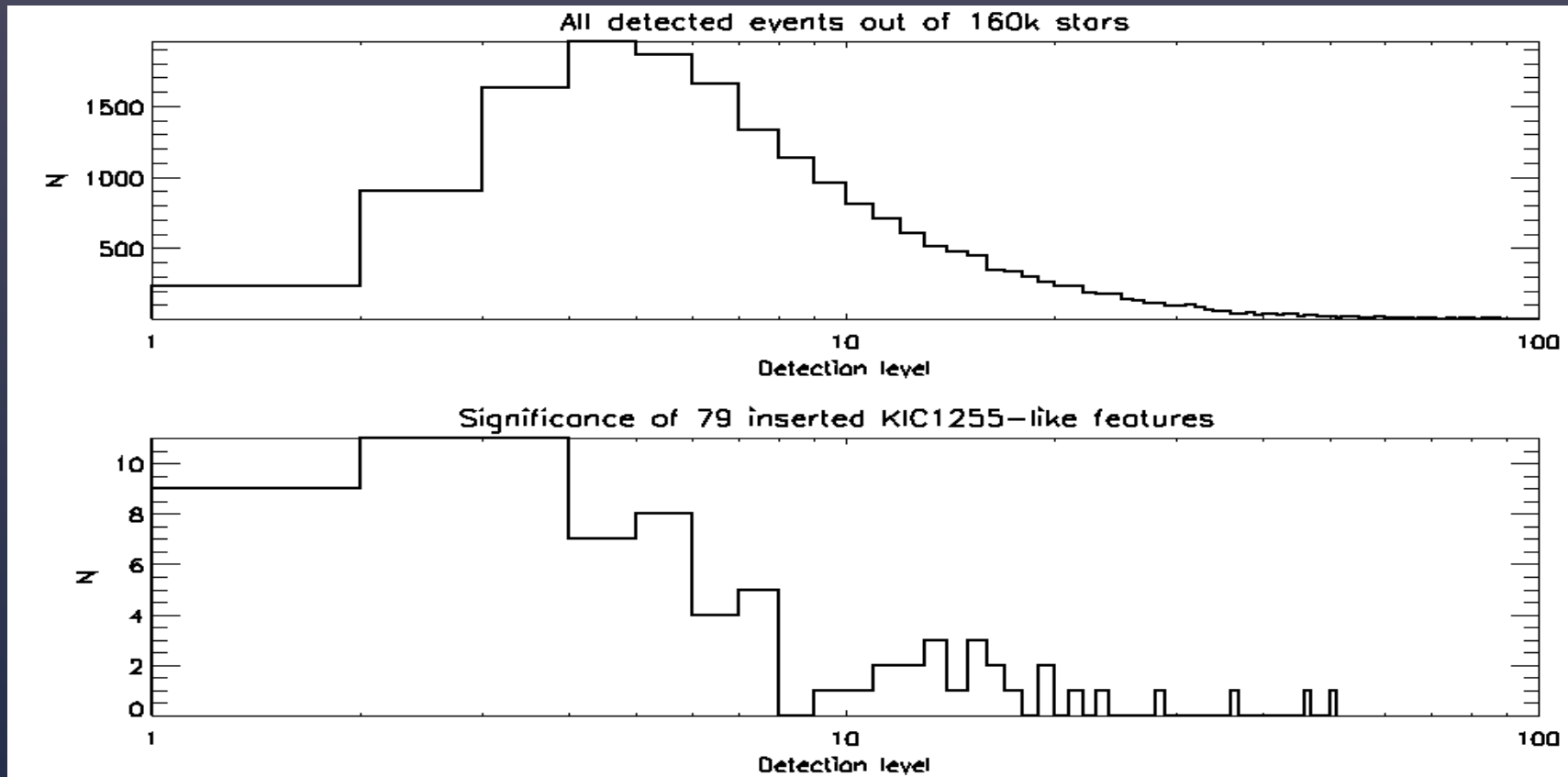
Recovered 79 out of 91 (87%) inserted KIC1255-like events

Second Approach: (not so) Fast and dirty search

- For each curve:

  - Perform a detrending in order to minimize jumps and/or notorious variations (e.g. variable stars)

  - Detection of EVENTS: when more than 2 (adjacent) points are above 2.5 times the RMS

  - When more than 12 EVENTS are detected the light curve is flagged (Based on the experience with tests in real CoRoT data)
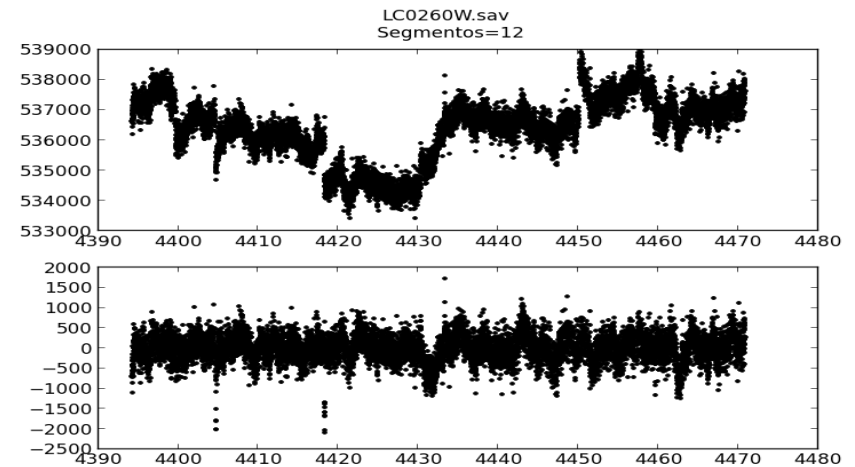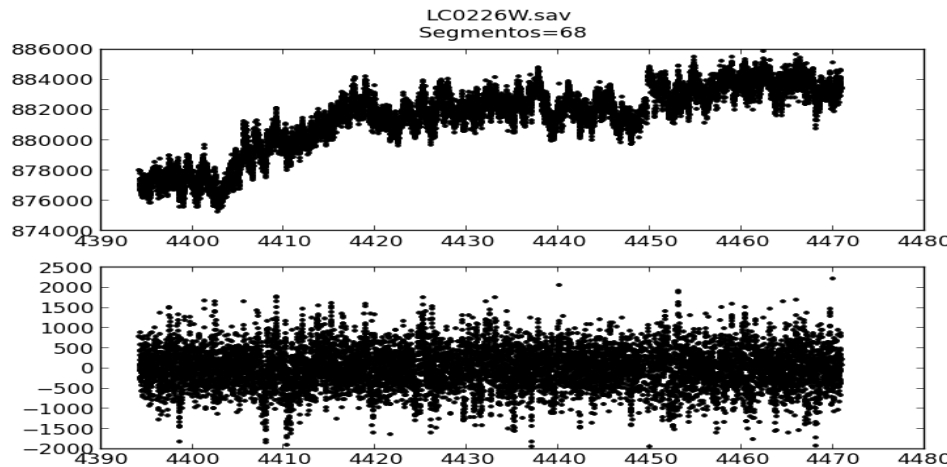
Second Approach: (not so) Fast and dirty search

- First implementation using 5000 Corot light curves + 50 curves with injected KIC-like objects

- Calculate significance of the detections based on the number of events, periodicity, RMS of the depths. Other numbers are also recorded.

- Ongoing work: Flagged objects (~300) are being checked before run the code over all the CoRoT light curves to choose the best parameters/constraints.
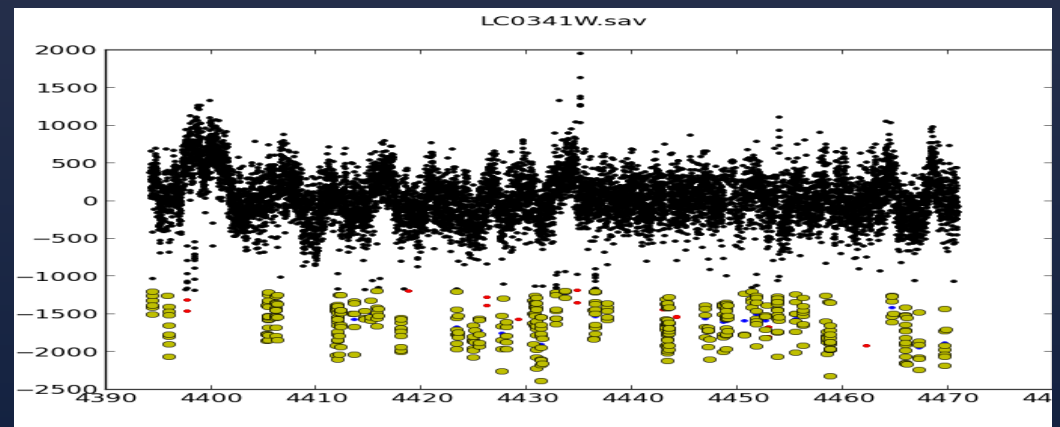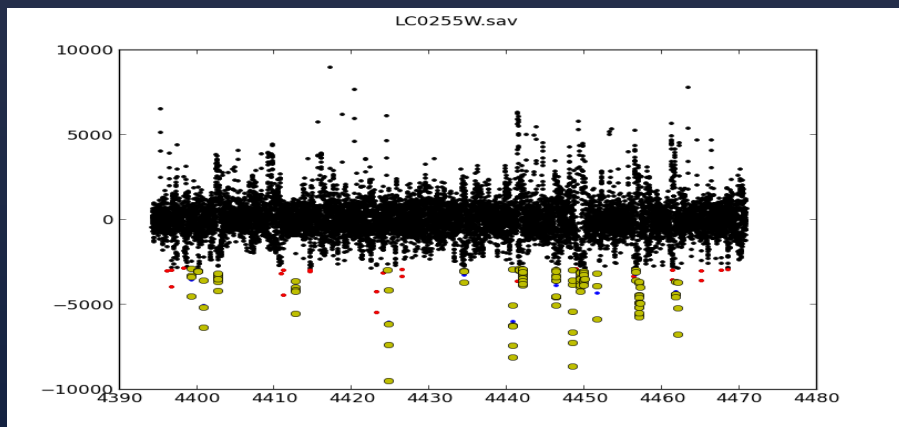
Conclusions and future work

- Peculiar/Extreme/Interesting objects might be hidden in the Corot data....is worth to perform more "flexible" searches.

- Better detrending approaches should be used.

- Measurements of asymmetry of the detections are being implemented (Bisector analysis, etc).

- Include more detections methods using phase-folded LCs (we will compare our results with BLS methods).

- Even the non-detection can be useful to refine the frequency of these objects. Improving the Spectral Typing also helps in this sense.

- This work can be extended to Kepler data