Additional Programs on binary stars

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1st CoRoT International Symposium , Paris Feb 4, 2009

CoRoT Eclipsing Binaries

- The EB sample: CVC classification EBs (ECL in class 1) available for IRA1, LRC1, SRC1, LRA1 + a few seismo-targets
- Almost all EXO-Ebs are new discoveries

Exo-EB frequency in the various runs.

run	CHR	MON	ALL	N_*(%)
IRA1	58 (66)	73 (95)	131	1.3%
LRC1	32 (56)	55 (86)	87	0.8%
LRA1	105 (134)	37 (52)	142	0.9%
SRC1	(56)	(95)		
TOTAL	195	165	360	

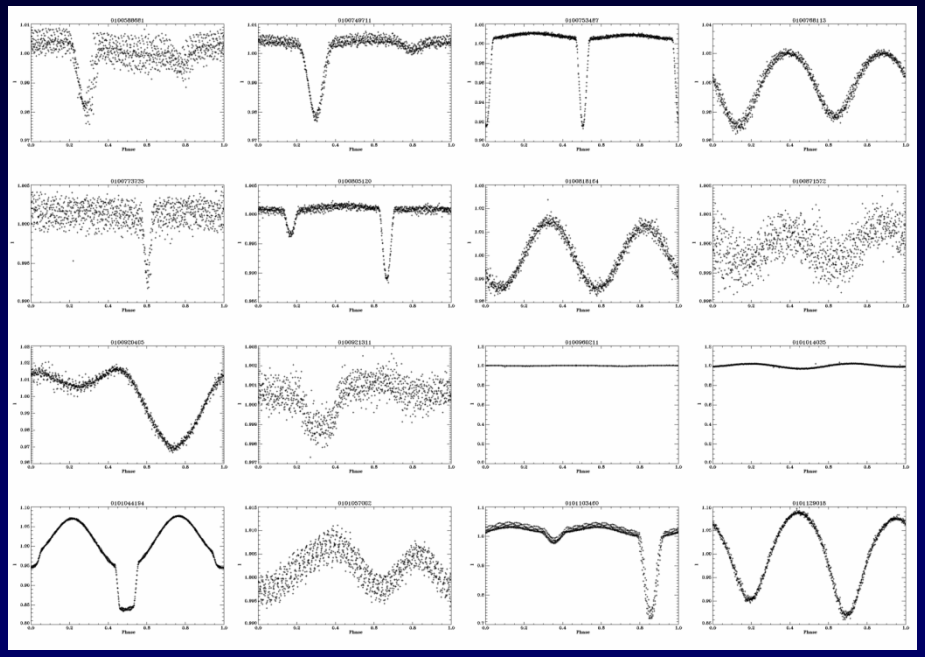
$\overline{N}_*$=1.1%

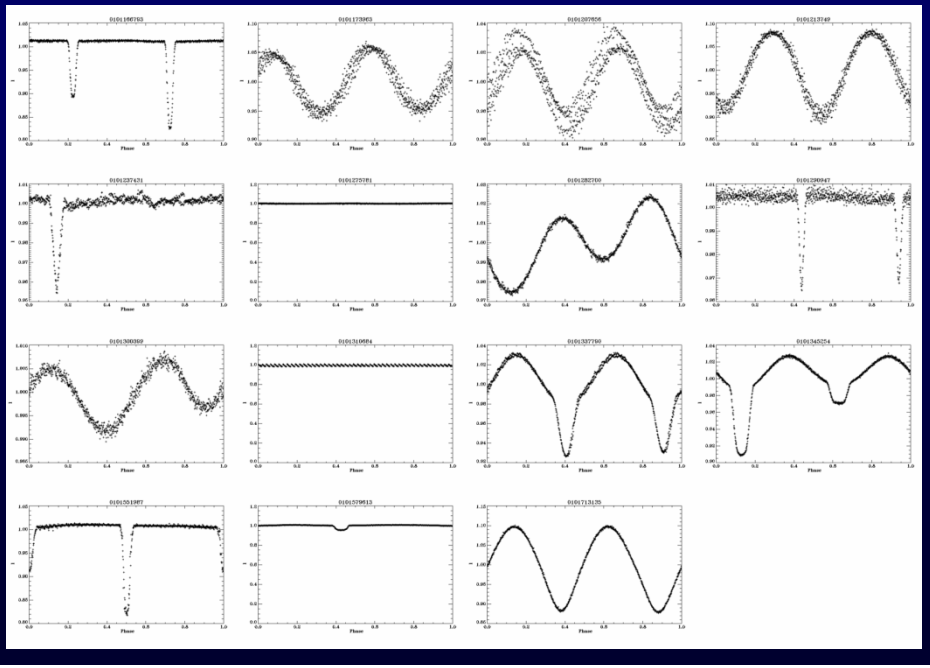
Slightly higher than GB surveys:

(0.5-1.0%)

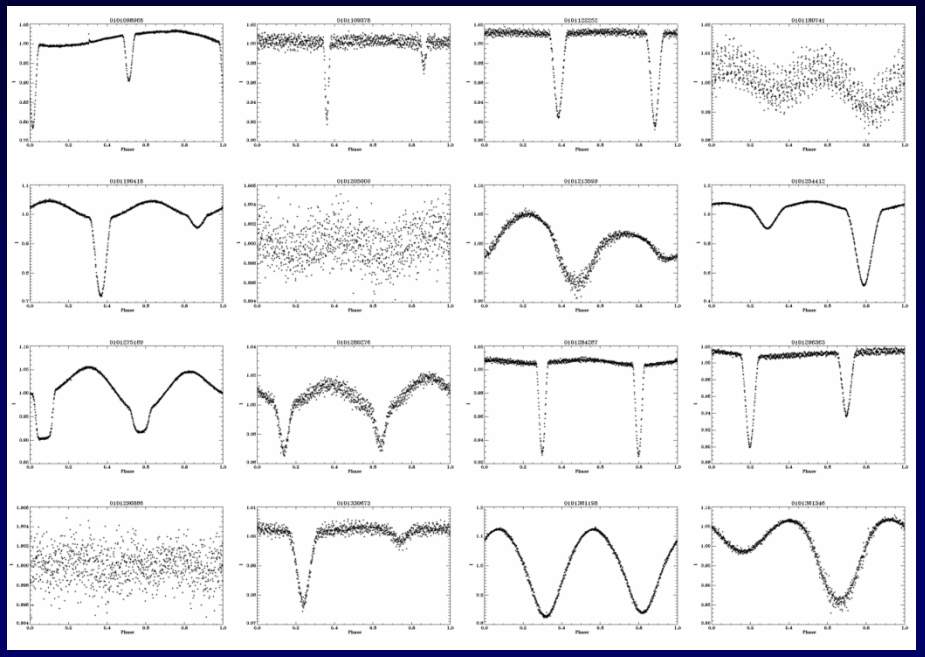
..and possibly underestimated!

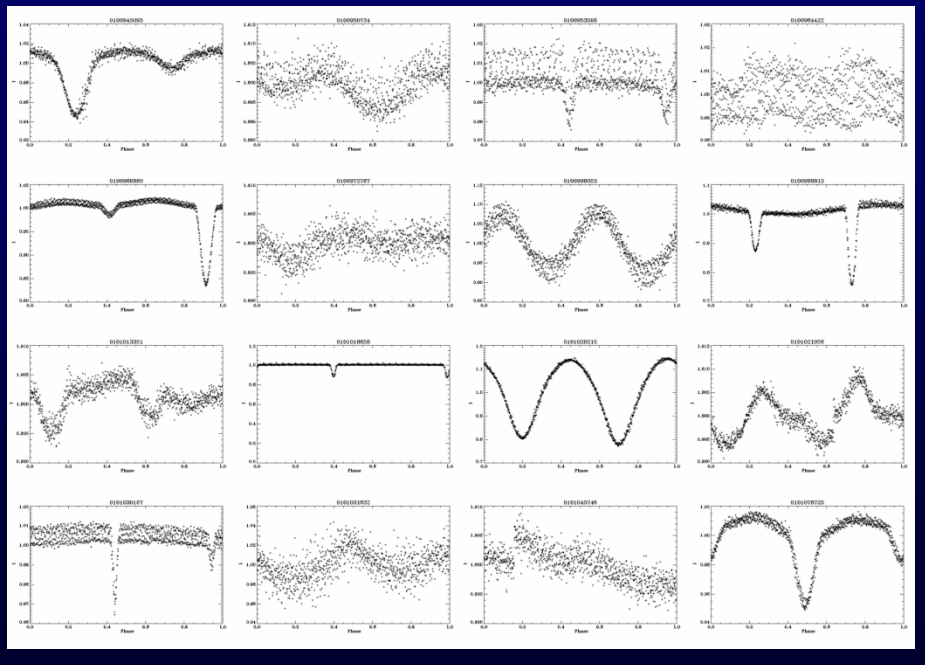
LRC1 - CHR





LRC1 - MON





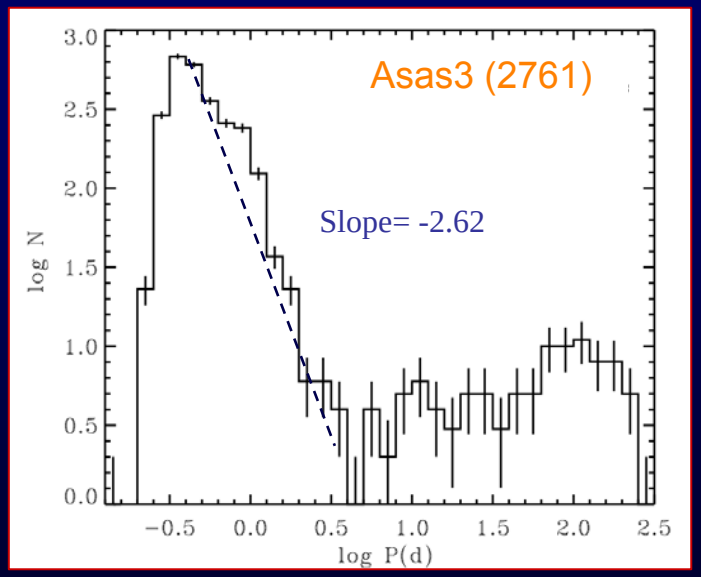
CoRoT Eclipsing Binaries: P distribution or: where have all the CB gone?

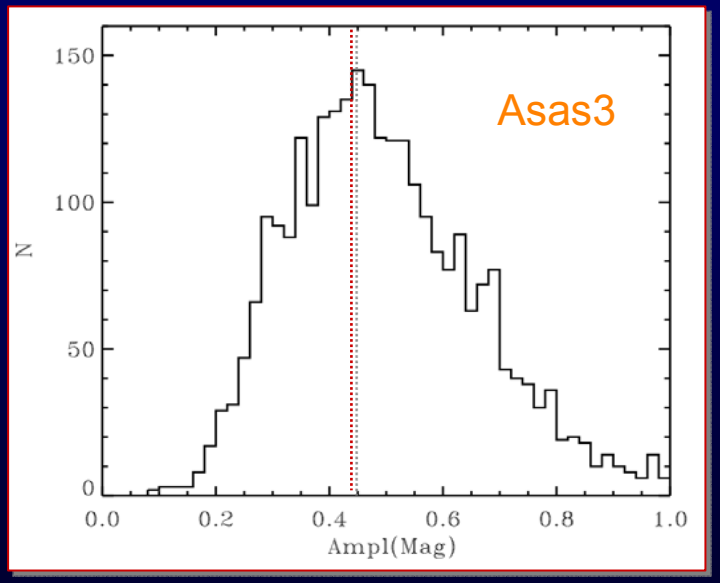
Observed distribution = true distribution (~flat in log P) * selection bias

Simple estimate of discovery selection bias : fraction of the 2π sr solid angle one star sees covered by the companion:

$$f \propto 1 - \sqrt{1 - \left(\frac{R_1 + R_2}{A}\right)^2} \approx \left(\frac{R_1 + R_2}{A}\right)^2 \propto A^{-2} \propto P^{-4/3}$$

Slope Log (N) – Log P = -4/3

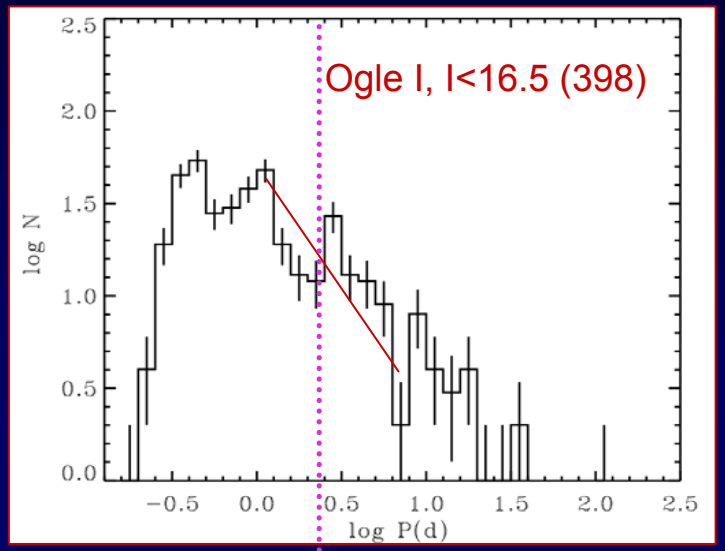


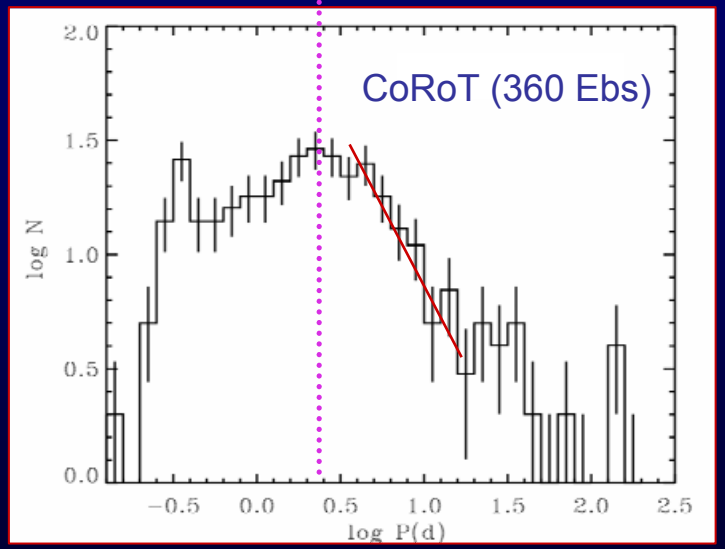


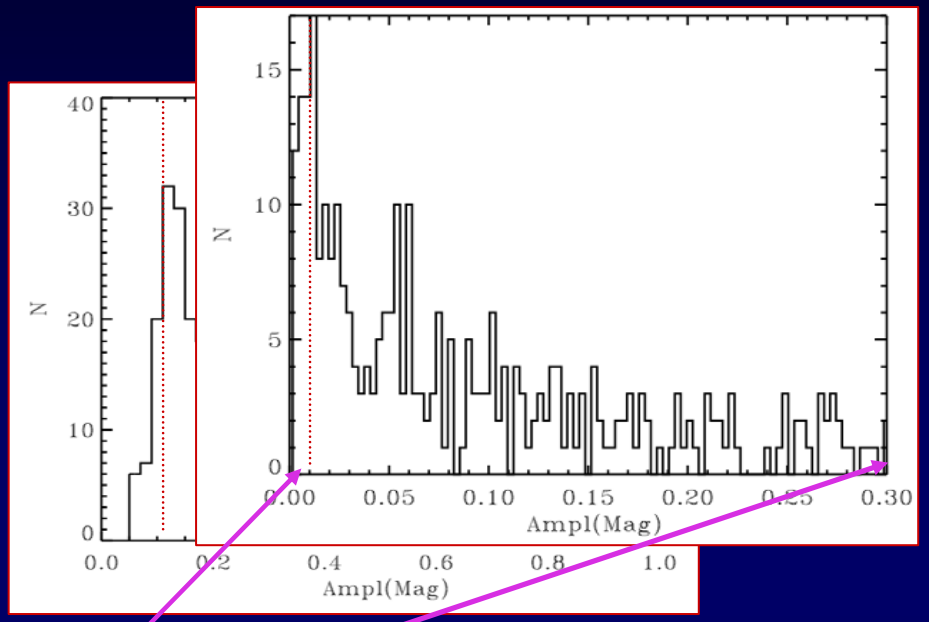
8.5<I<15

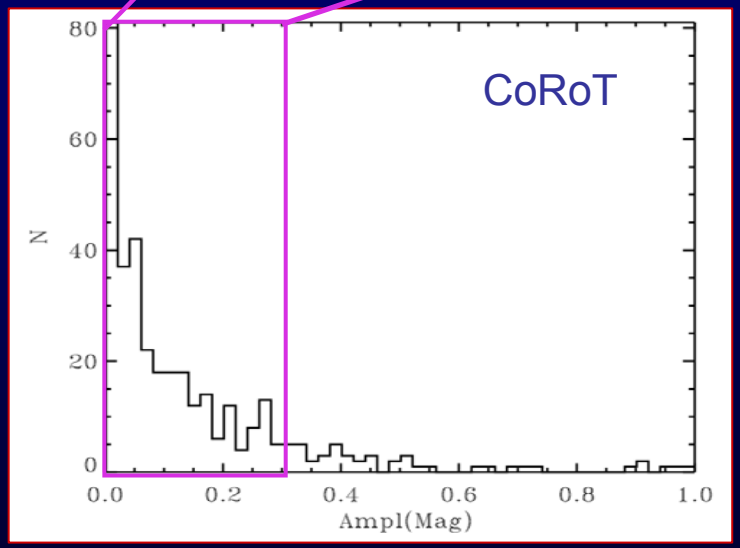
Completeness ~0.4 mag!

P distribution, II









EB light curve analysis

Supplemental information / specific tools needed:

- Target characterization: GB Strömgren photometry (poster VI-060)
- FU spectroscopy (radial velocities)
- Implementation of CoRoT bands (flux - limb darkening computation) in lc synthesis code (Phoebe-WD, thanks to A. Prša)

Other helpful tools:

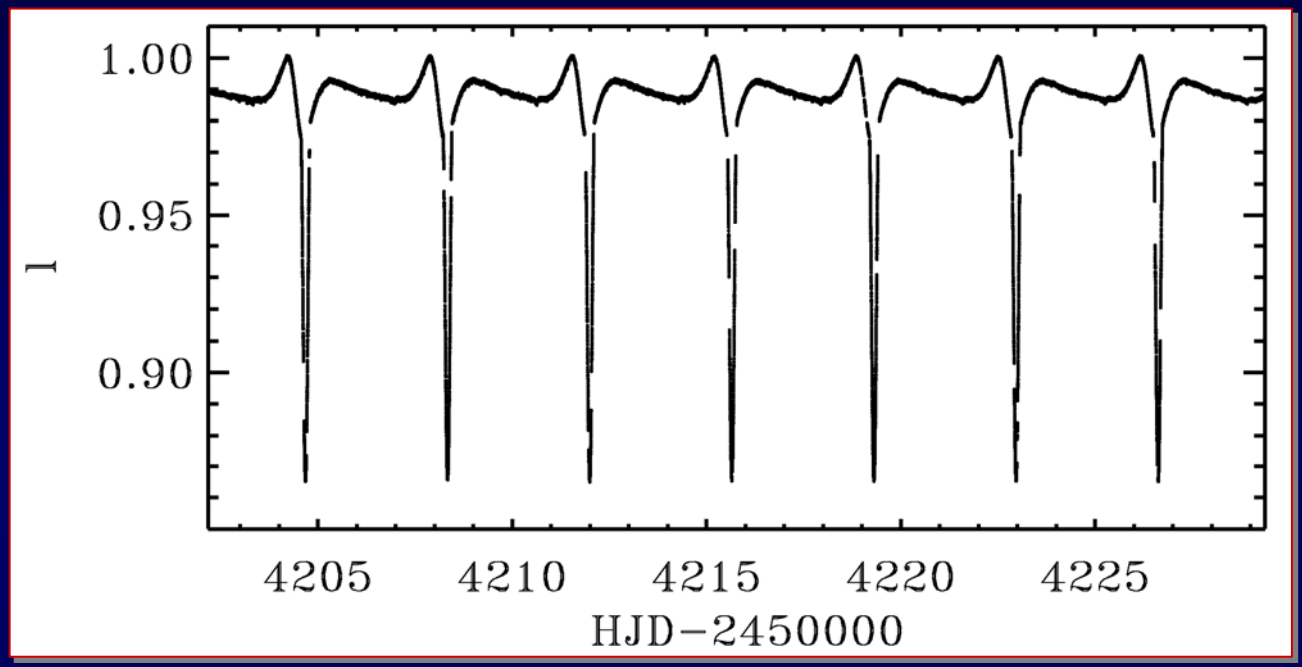
- BTT database of CVC-cl1 light curves
- BTT Wiki for info exchange

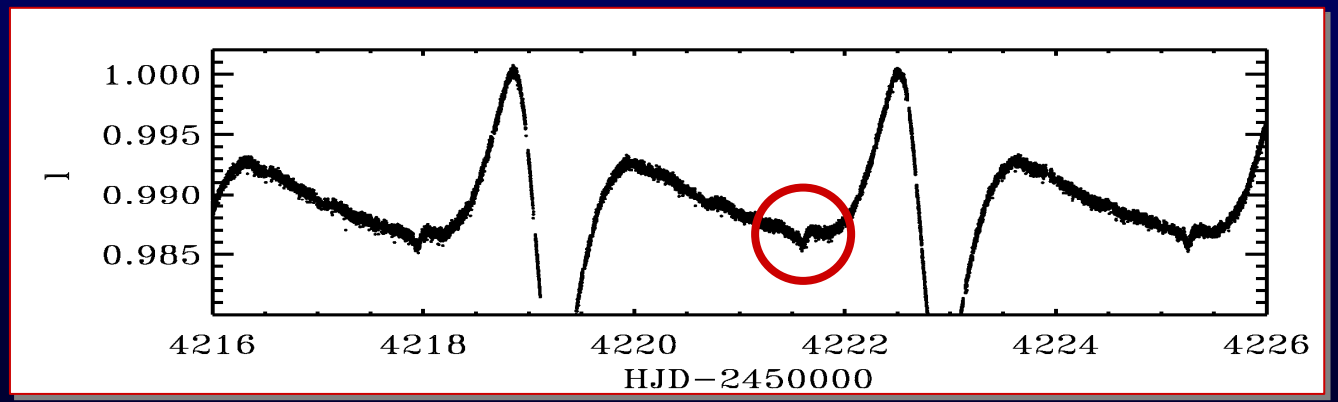
The unexpected gift: HD 174884

(P.IX-094, J. Montalbán et al.)

Seismo – secondary target in SR1
Binary nature not known before

Very stable light curve, after folding & binning
r.m.s. σ=0.00011

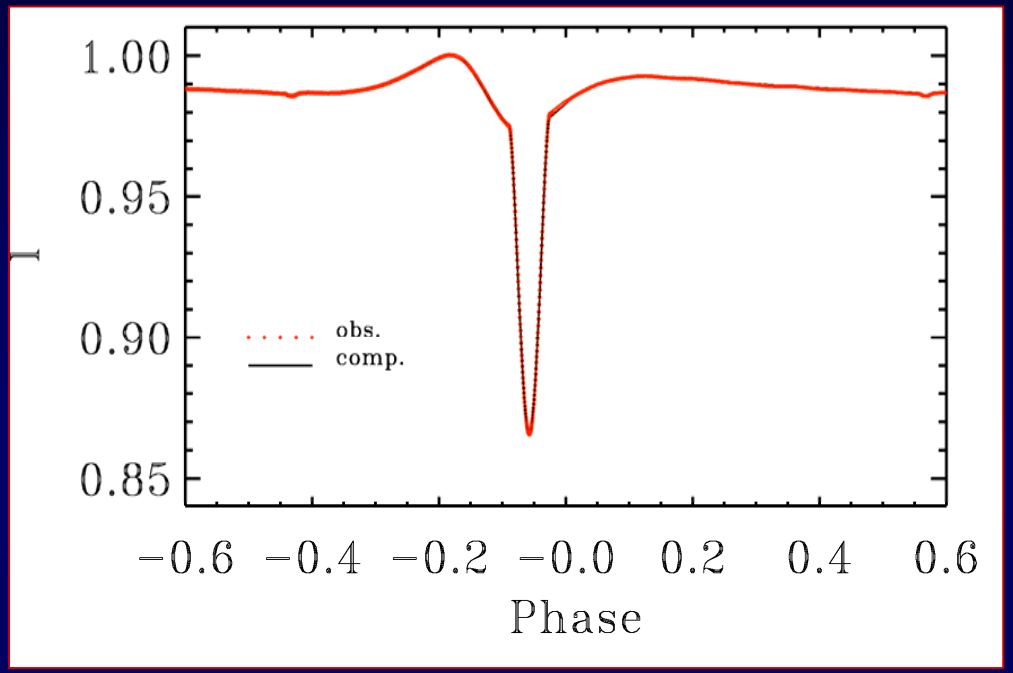


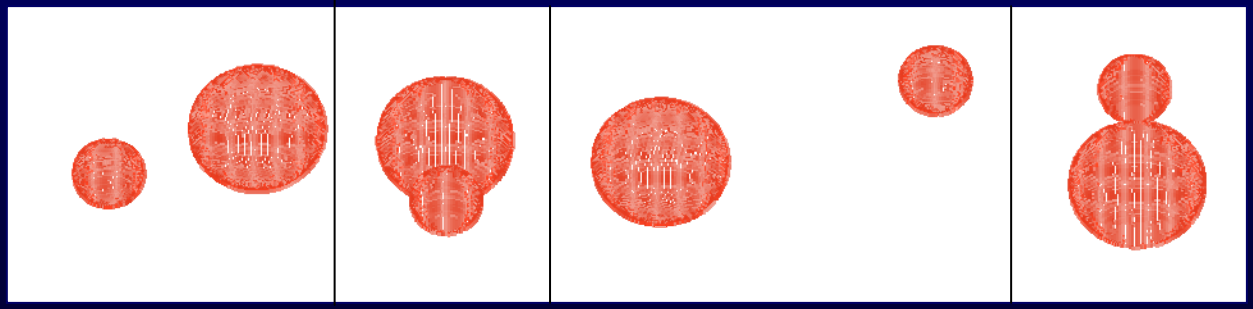


HD 174884, LC shape

Short period (3.66^d)
Difference in minimum depth almost entirely due to
high eccentricity (~0.3)
Orientation in space

r1/r2=0.53
T_1/T_2=1.1
q=0.66





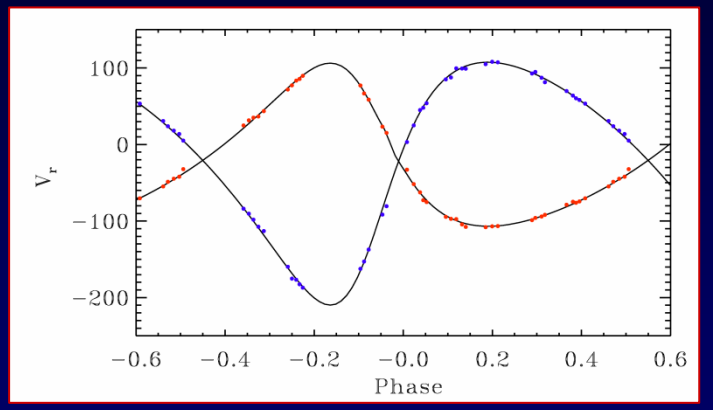
HD 174884, analysis

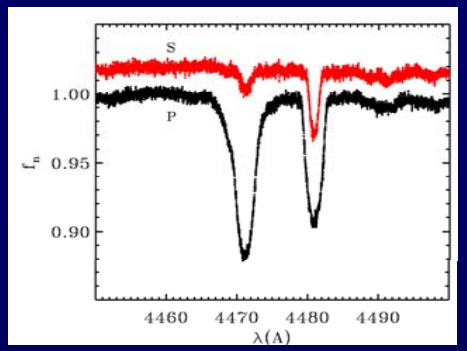
CoRoT photometry + Coralie HD spectra

LC analysis: Phoebe-WD heuristic scan of parameter space

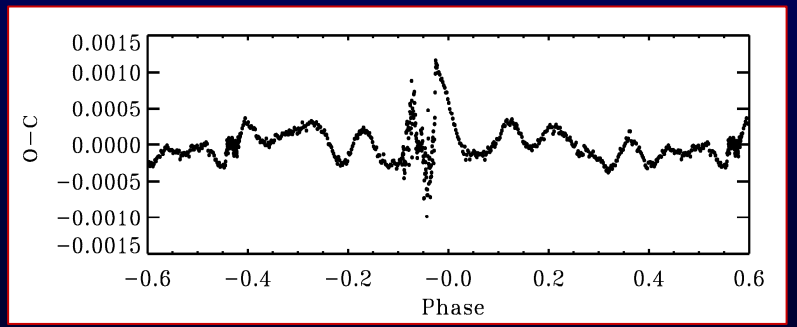
RV: different methods for spectra analysis (profile fit, spectra disentangling)

Search for the appropriate theoretical models ⟶ age estimate





- Excellent agreement among results from different methods applied to different datasets (see poster).
- Overall consistent picture
- hints of tidally induced pulsations



Binaries with pulsating components

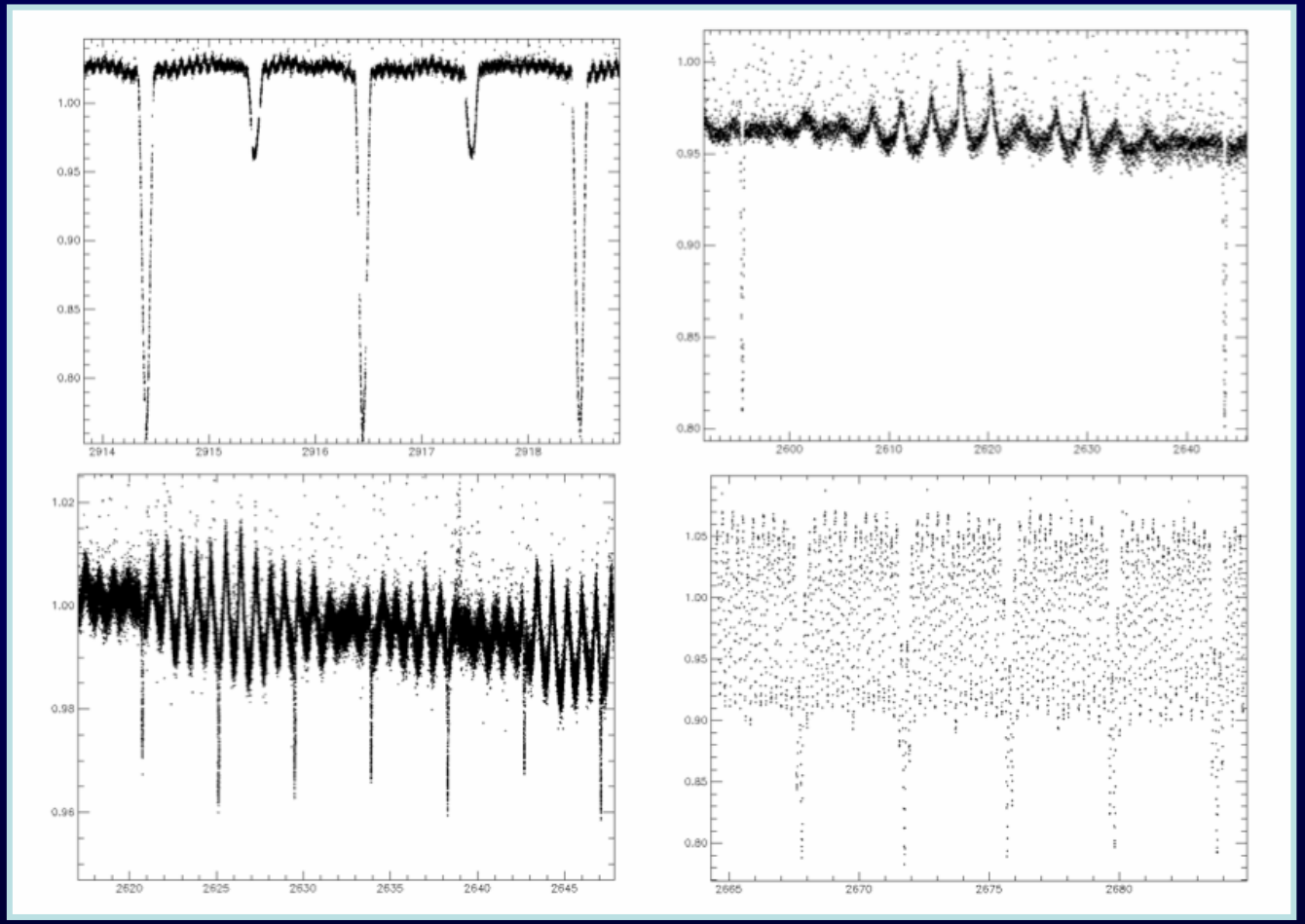
(P IX-096, P. Lampens et al.)

A dozen target selected from various runs.

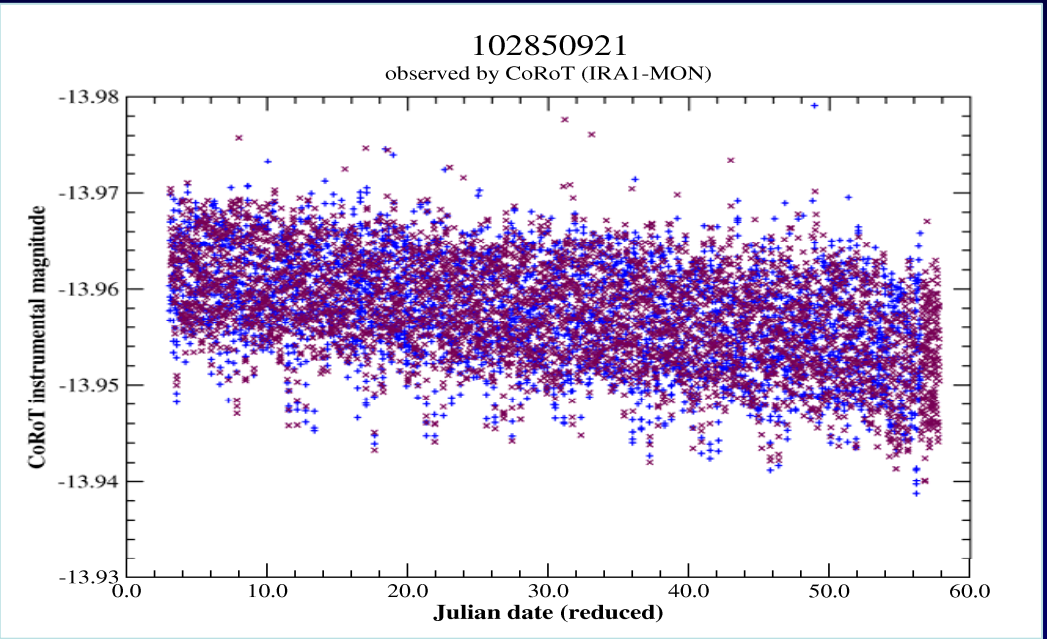
9/10 not classified as binaries by CVC

Iterative procedure to clean pulsation and binary-lc

Pulsating binary zoo



EBs with pulsating components, II



Corot 102850921

Detrend

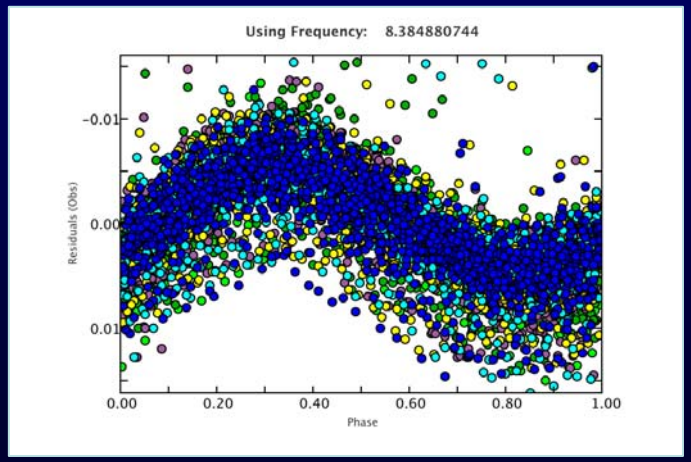
Fourier analysis with Period04:

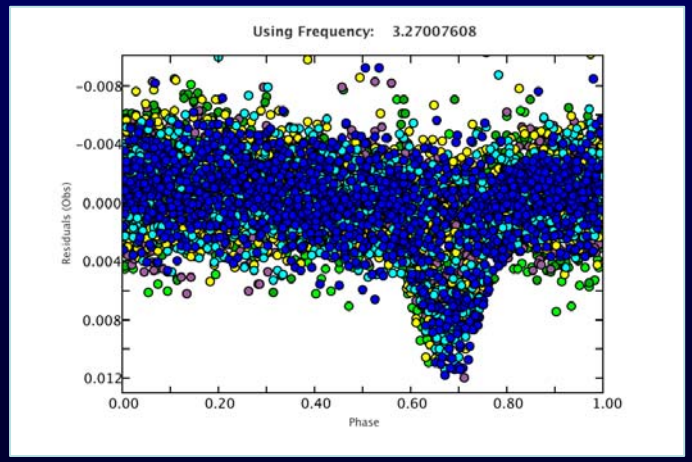
1st frequency: pulsation

2nd frequency: orbital

To be iterated

f_{puls}
$P=0.11^d$





$2f_{orb}$
$P=0.6^d$

low mass binaries (lower MS calibration)

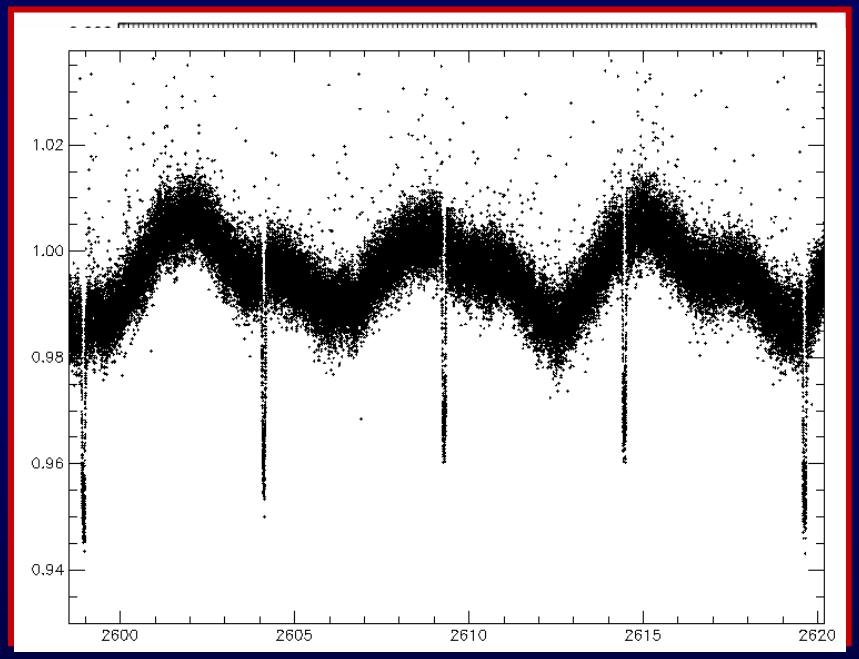
P.IX-095, J-C Marales et al.

Selection of possibly low-mass component binary from IR colors and lc shape for:

FU spectroscopy with FLAMES + UVES (LRc1)

E2-0203 (a.k.a. Corot 0102825481)

LACEP BE PVSG?



SB1 => f(m), primary G5, q=0.16

Conclusions

The binary thematic team got till now a few hundreds of (mostly newly discovered) Ebs from CVC (available to BTT members from a dedicated database)

The data analysis started with some delay with respect to data distribution to CoIs, but we have exciting / very promising results

The results of HD 174884 shows the 'power' of Corot data accuracy (parameters well constrained with grazing eclipses) and the adequacy of the methods (and of the underlying models).

The bottle neck is often the need of additional data, tipically RV curves, to fully exploit Corot photometry information.

Thank you for your attention!