The chase for exoplanet false positives and contamination corrections

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1. Aperture photometry in the exoplanet channel
2. Modeling of exoplanet imagettes
3. Chasing exoplanet false positives
4. Conclusions

1 Aperture photometry in the exoplanet channel

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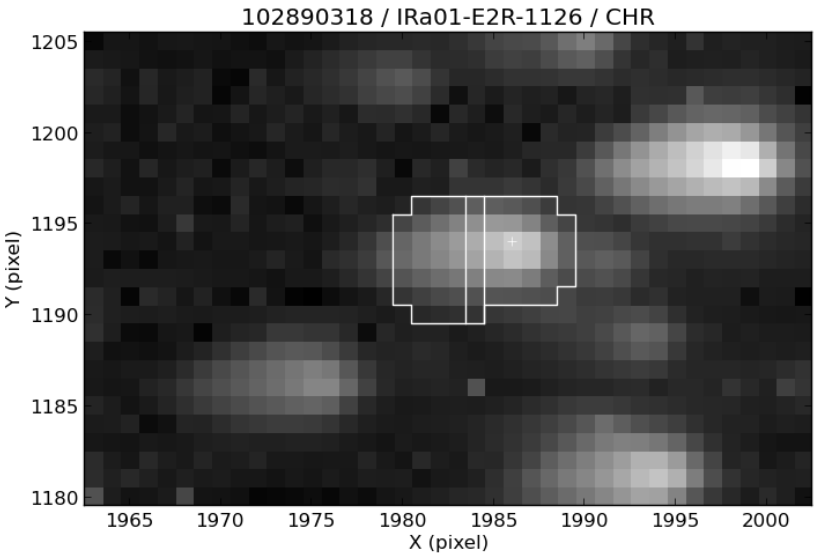
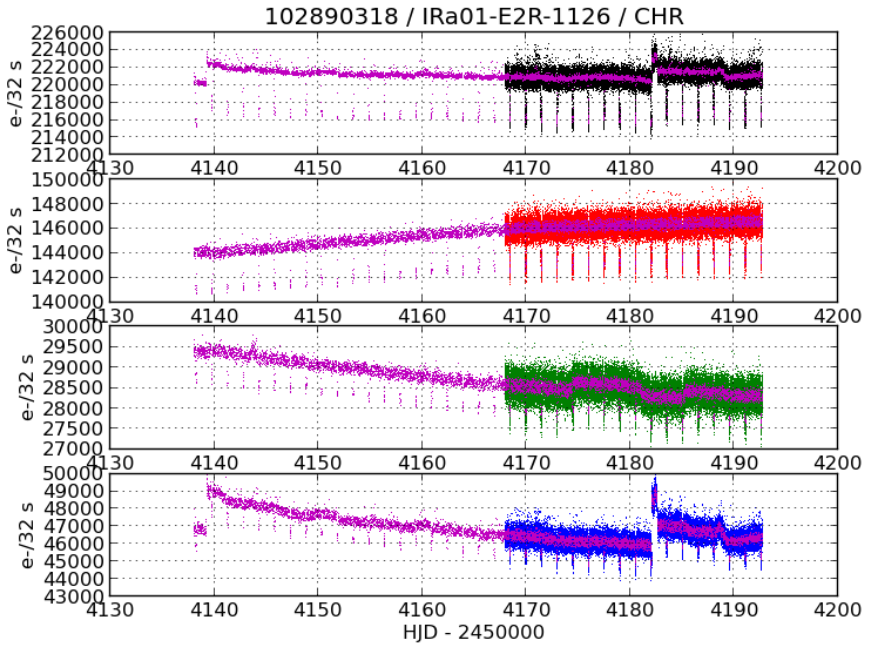
From photometric masks to (3-color) light curves



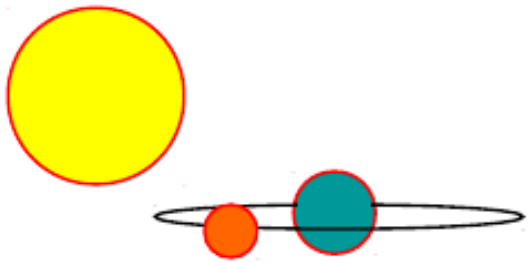
Corot-1 as seen by Corot



Corot-1 white and color LCs

Because the PSF is large (10 pix $\leftrightarrow$ 23″), neighboring PSFs overlap.
$\Rightarrow$ The fluxes of neighbor stars leak into the target mask.

Consequences for exoplanet search



Flux contamination by neighboring stars:

- modifies transit relative depths, hence inferred companion radii;
- creates exoplanetary-like transits = *false positives*.

⇒ Know your target environments + correct for flux contaminations.

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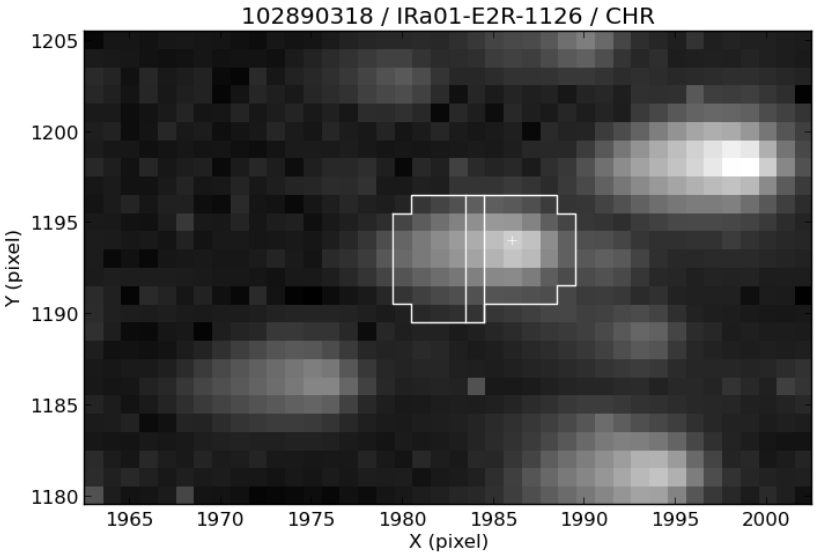
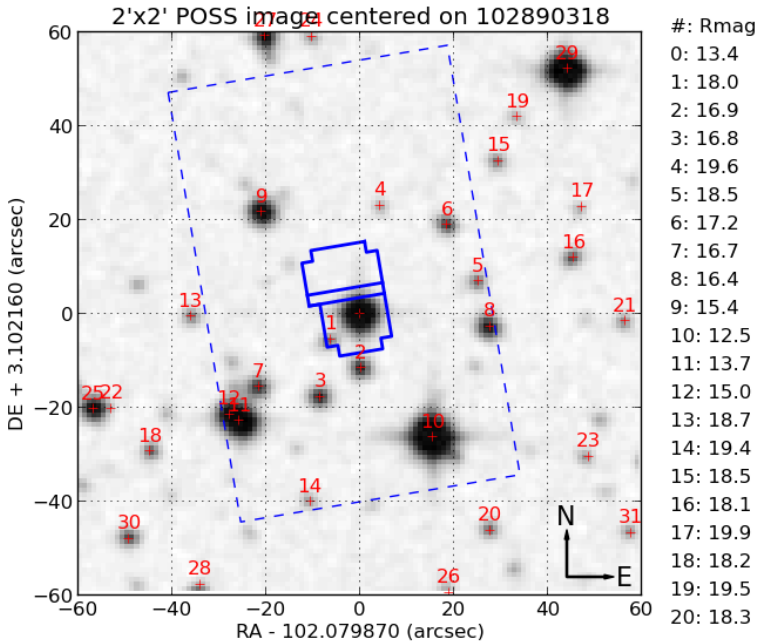
Using higher resolution images

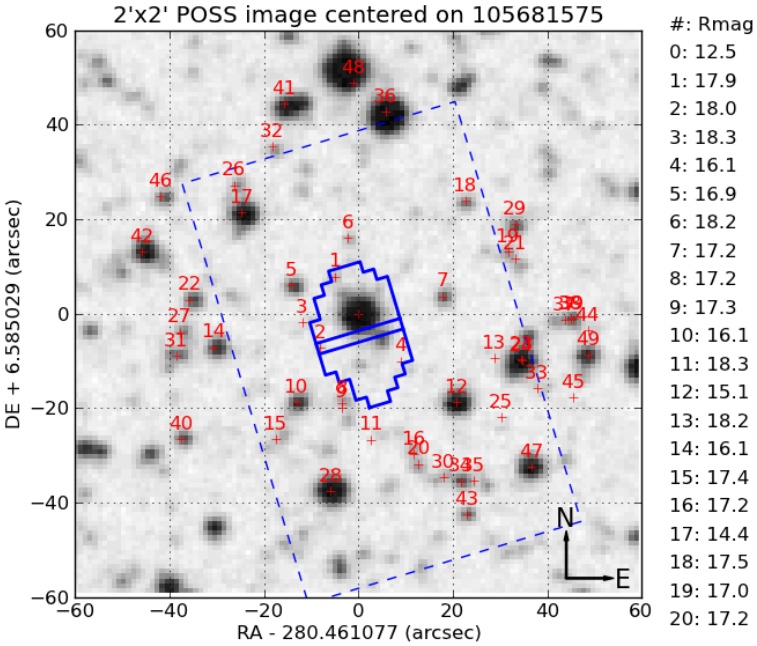


Corot imagette

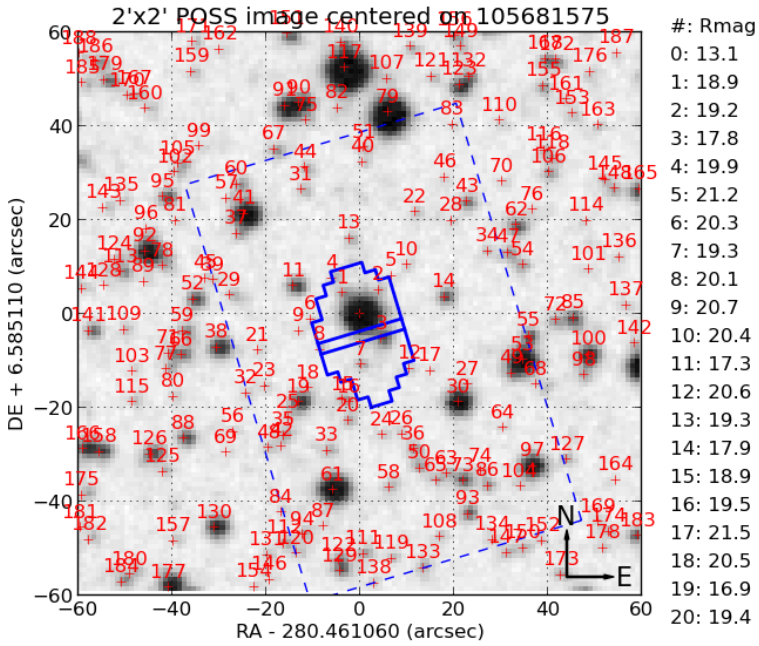


Palomar + Exodat

The need for a good stellar catalog

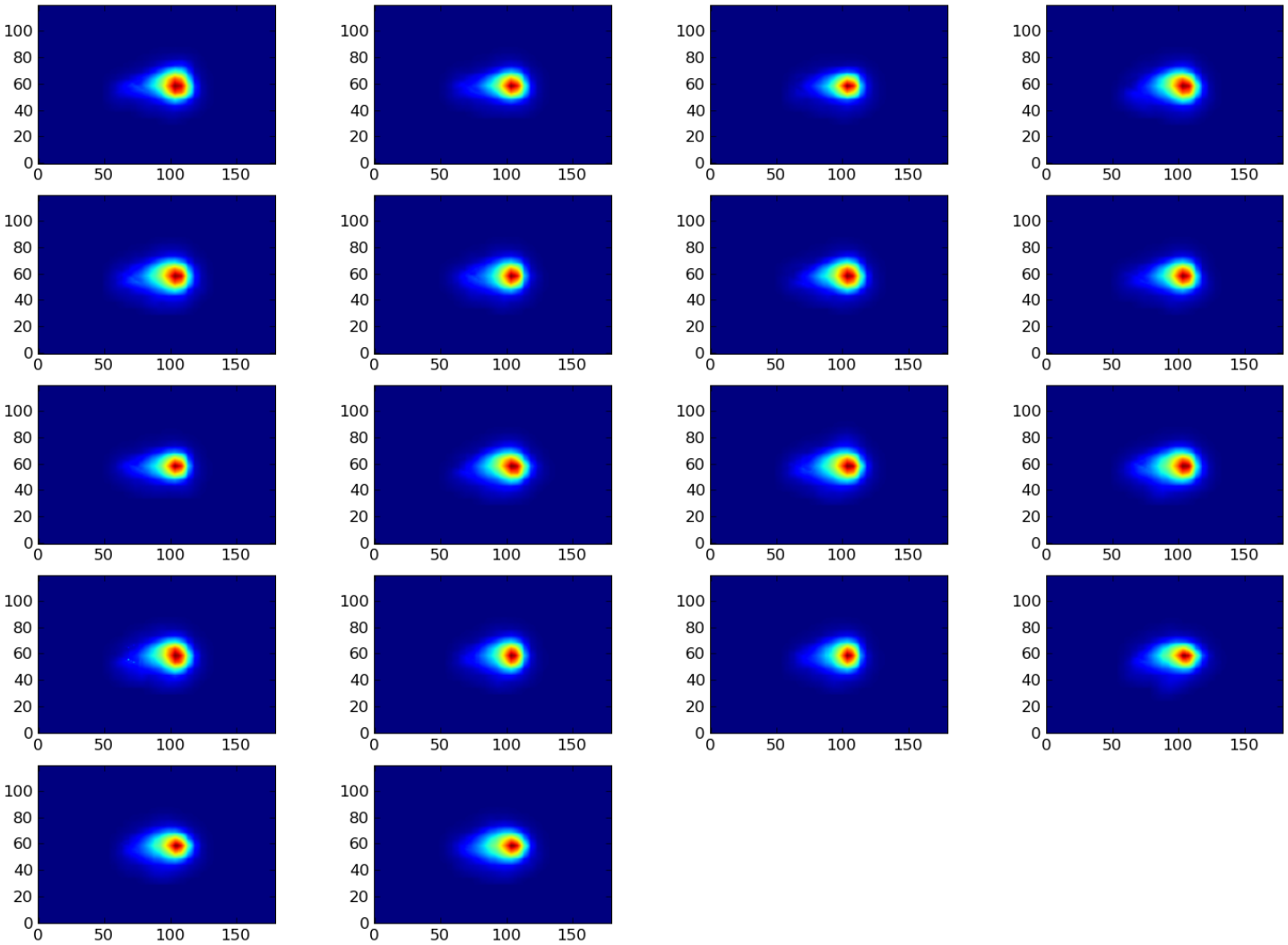


PPMXL catalog

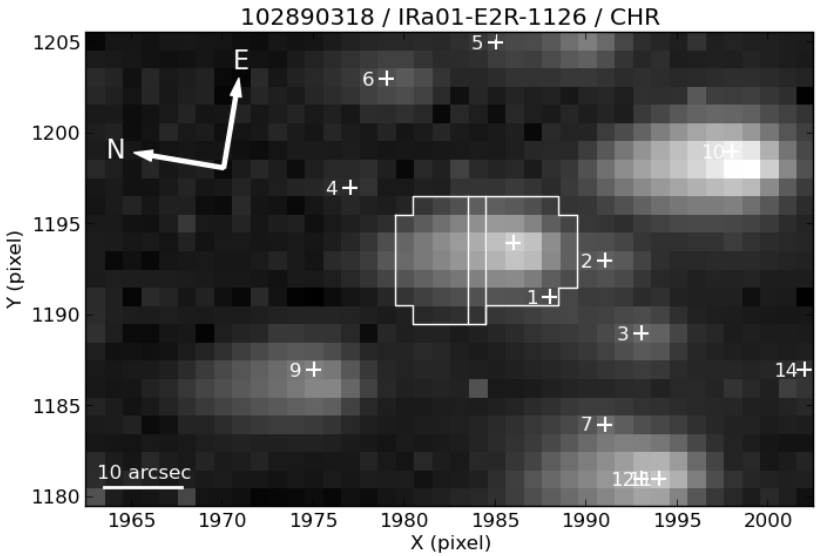


Exodat catalog

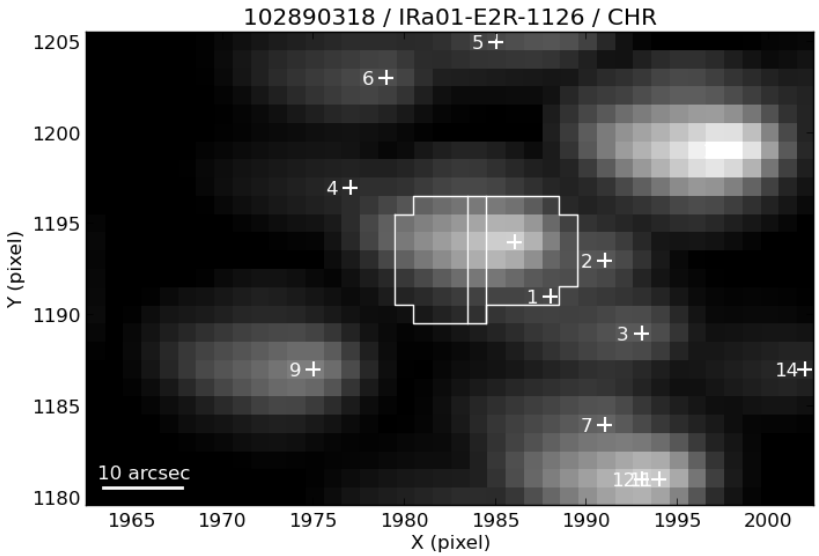
Corot PSFs



Contamination computation (1)

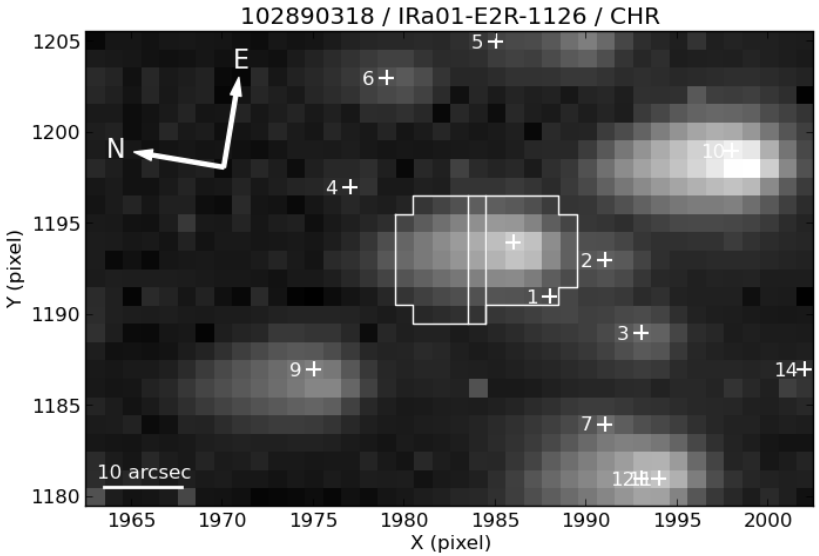


Original

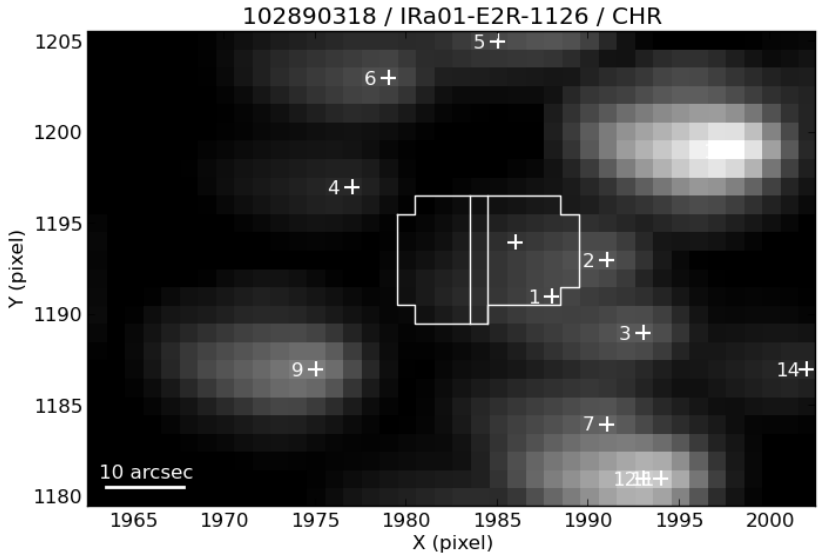


Computed

Contamination computation (2)

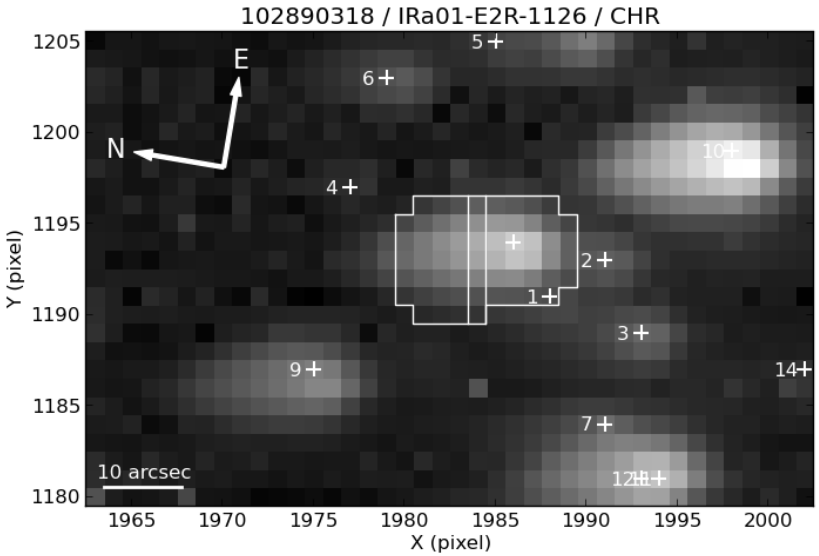


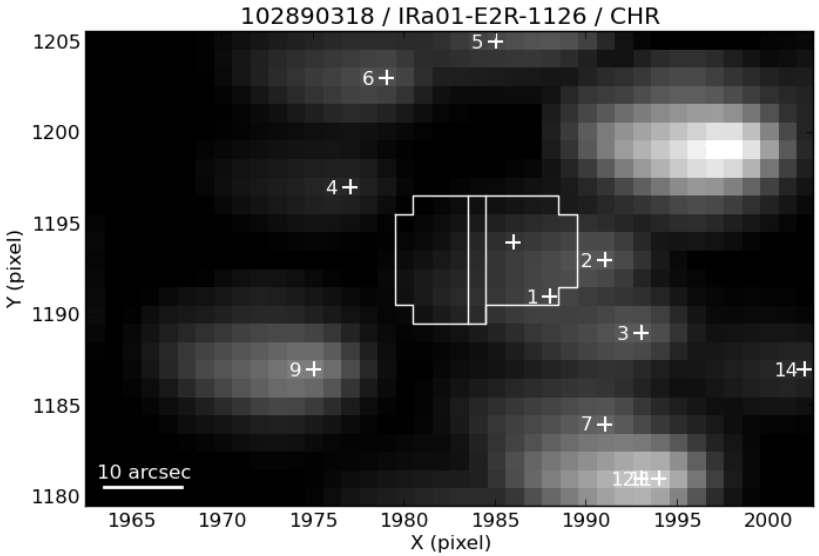
Original



Target removed

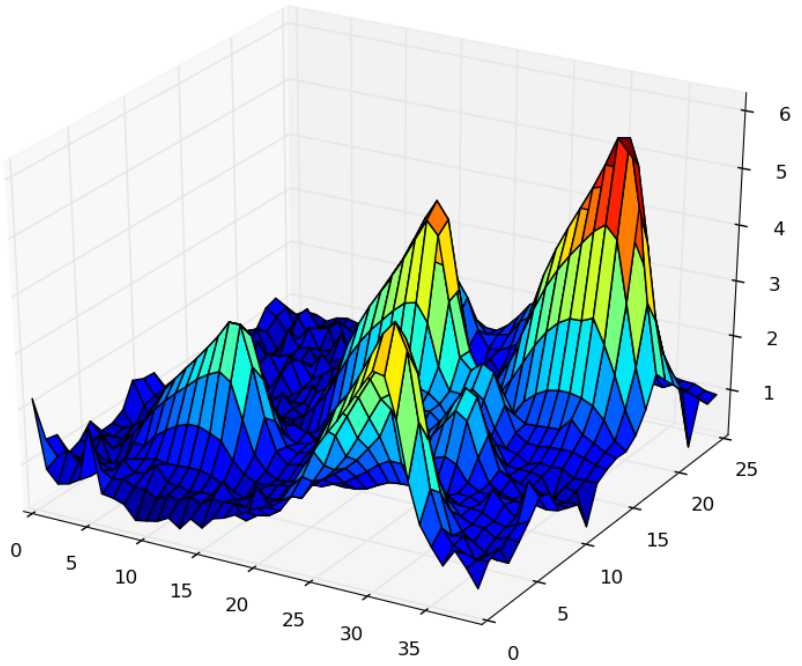
Contamination results

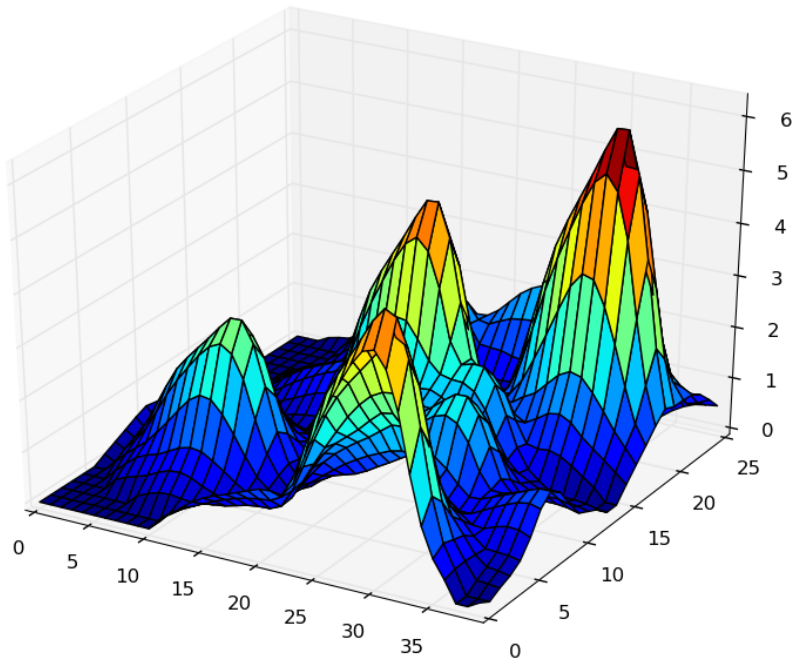




white = 3.1 %, blue = 0.6 %, green = 1.1 %, red = 5.0 %

What about accuracy/uncertainty?





Complex problem $\Rightarrow$ should be Monte-Carlo computed
(to be completed soon).

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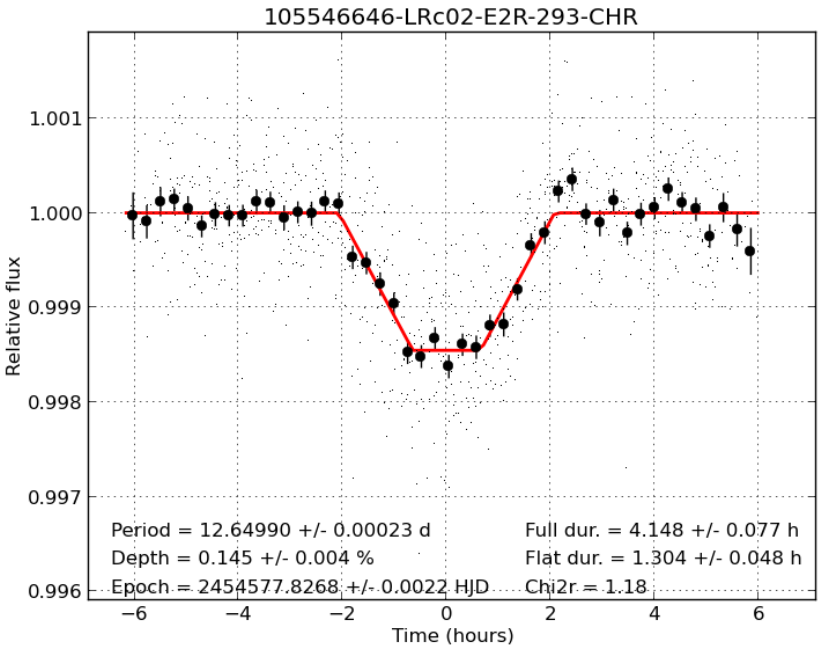
White contamination per neighboring star

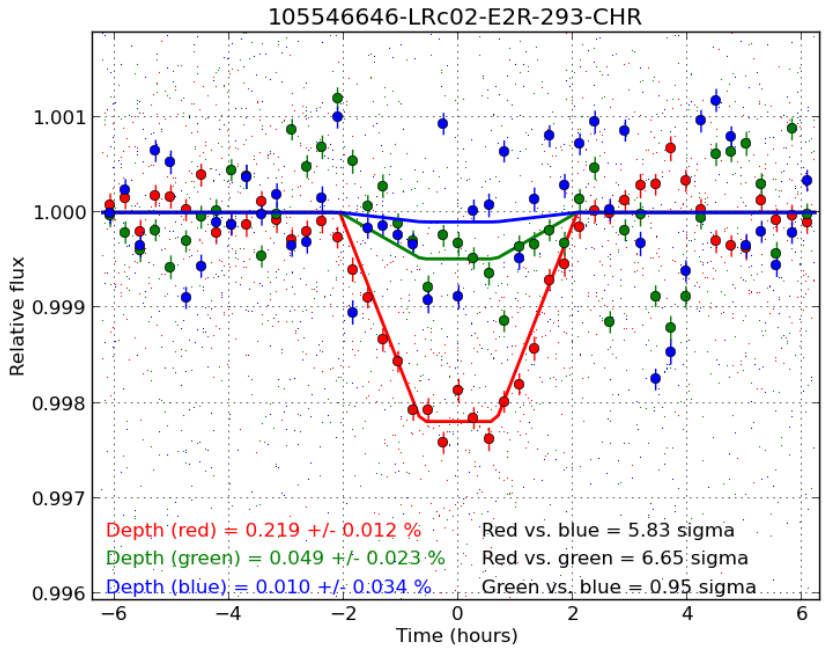
#	arcsec	Corot ID	RA, DE	X, Y	r'
0	0.00	102890318	102.079870, -3.102160	1986, 1194	13.43
1	8.24	102890027	102.078160, -3.103680	1988, 1191	17.96
2	11.52	102890327	102.079910, -3.105360	1991, 1193	16.87
3	19.65	102889909	102.077530, -3.107090	1993, 1189	16.75
4	23.41	102890547	102.081070, -3.095770	1977, 1197	19.63

#	arcsec	r'	flux	%	dF/F
0	0.00	13.43	7405	96.91	2.23
1	8.24	17.96	81	1.06	> 100
2	11.52	16.87	148	1.95	> 100
3	19.65	16.75	6	0.08	> 100
4	23.41	19.63	0	0.00	> 100

Unveiling a contaminating eclipsing binary (1)

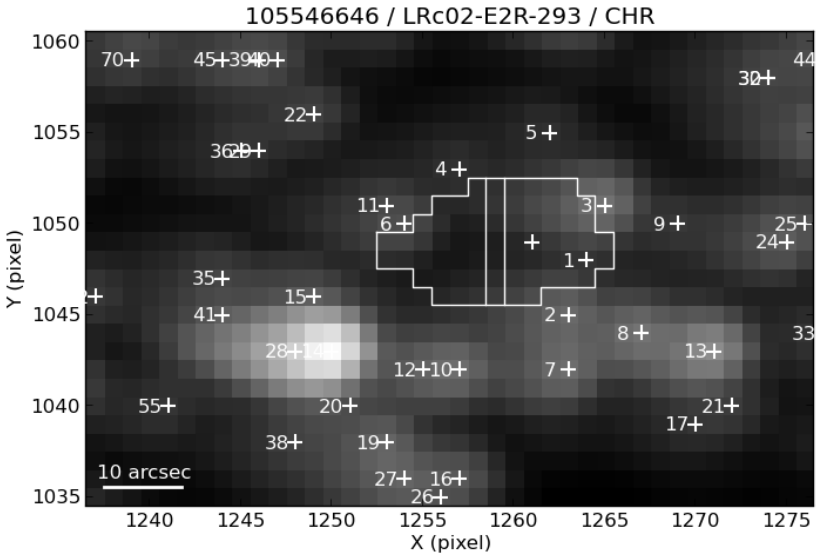


Folded white transit

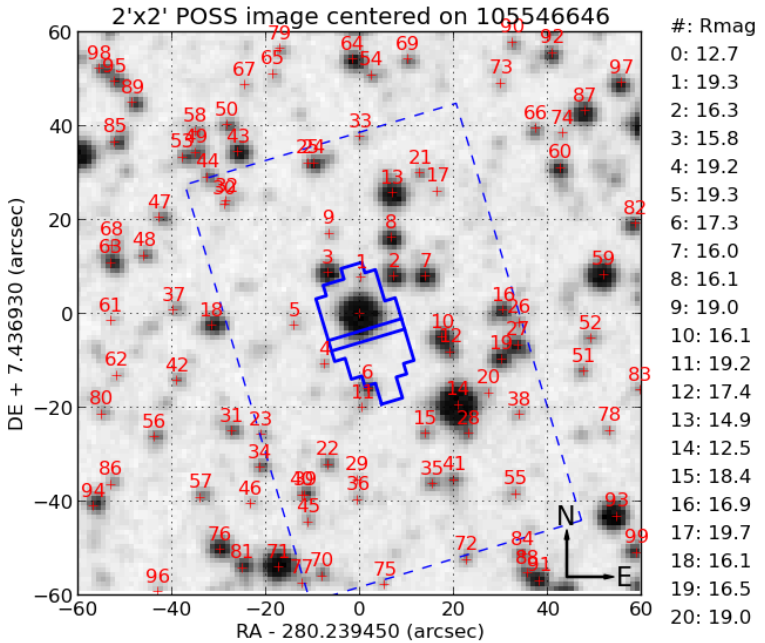


Folded color transits

Unveiling a contaminating eclipsing binary (2)



Computed imagette



Palomar + Exodat

Unveiling a contaminating eclipsing binary (3)

#	red (%)	dr/r	green (%)	dg/g	blue (%)	db/b
0	94.81	0.23	98.79	0.05	96.96	0.01
1	0.30	73.97	0.05	> 100	0.04	25.82
2	0.68	32.08	0.50	9.66	0.45	2.22
3	4.11	5.33	0.61	8.02	0.33	3.06
4	0.00	> 100	0.01	> 100	0.08	12.16
5	0.00	> 100	0.00	> 100	0.00	¿ 100
6	0.00	> 100	0.00	> 100	2.05	0.49

For a CEB, we expect: dr/r $\simeq$ dg/g $\simeq$ db/b.

$\Rightarrow$ the culprit is contaminant #3!

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Take-home messages

Contamination by neighboring stars:

- can be computed using Corot & Exodat data;
- should be accounted for before estimating exoplanet parameters.

Contamination calculations:

- make it possible to identify some exoplanet false positives;
- can be used to inform follow-up and save time.