



Scoperta casuale di un interessante sistema binario

Alessandro Marchini

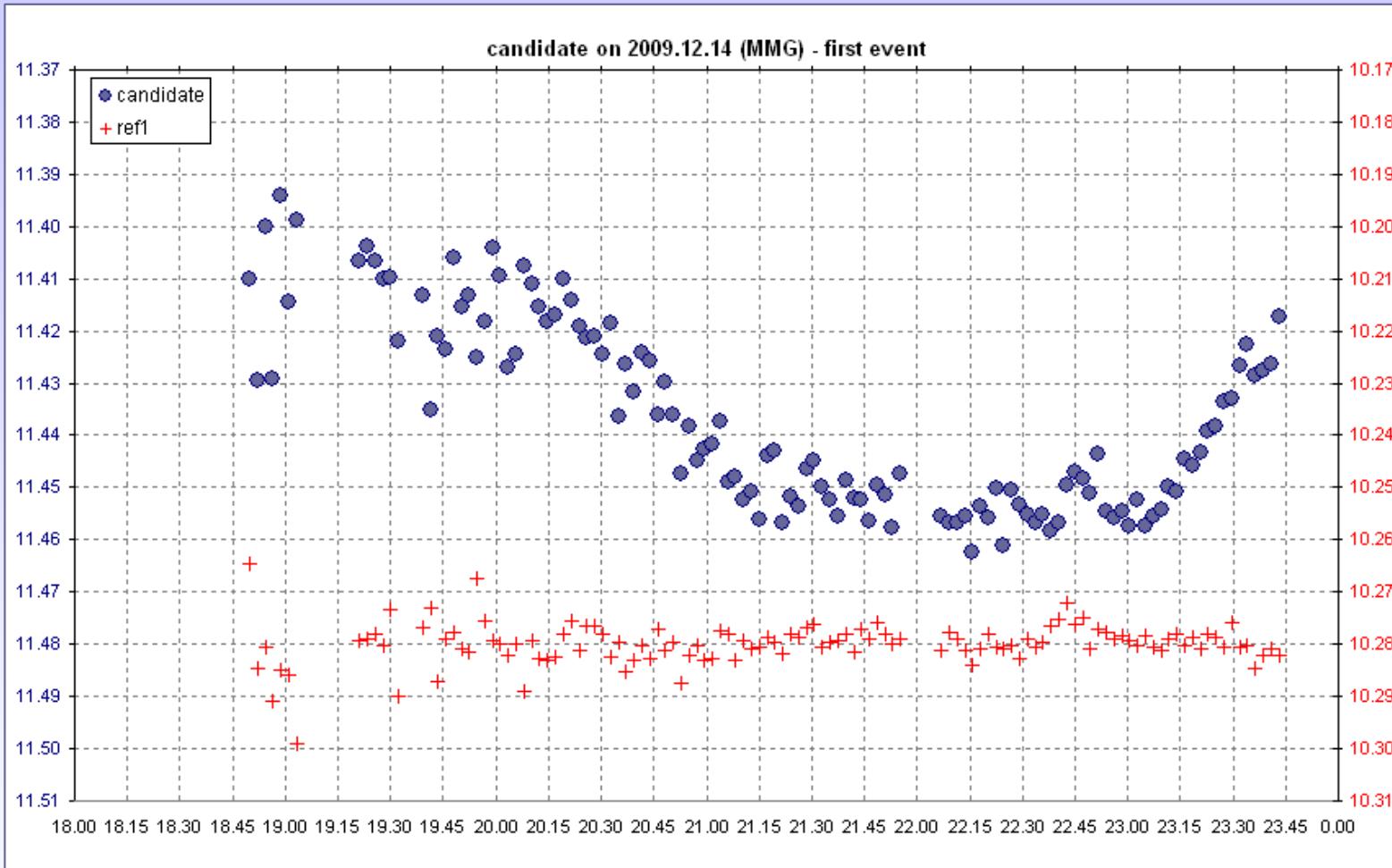
Osservatorio Astronomico, Università degli Studi di Siena



VI Meeting Stelle Variabili - Amelia, 15-16 maggio 2010



A serendipity discovery



Check star in
the field of a
variable star

2009.12.14
Maurizio
Martinengo

**First event
detected**

Exoplanet or false alarm (binary star)?
Not an RR Lyrae or a SPP star!

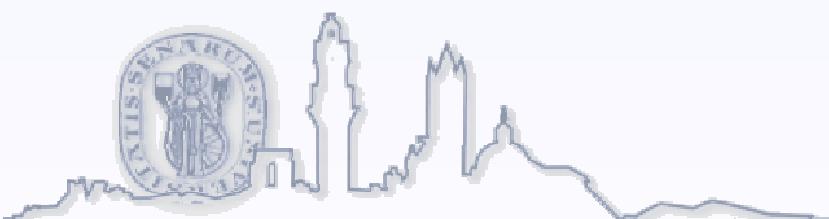


We need an expert...

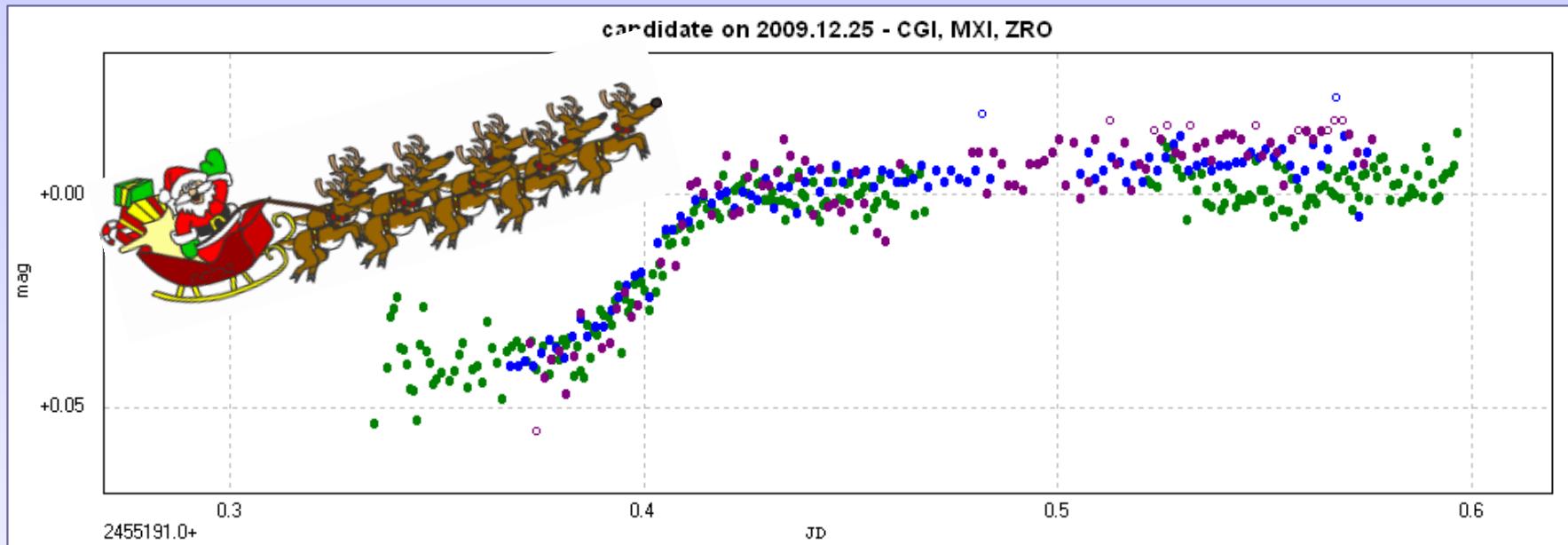


Mauro Barbieri's suggestions:

- data mining
- observe...
- no chance for an exoplanet!



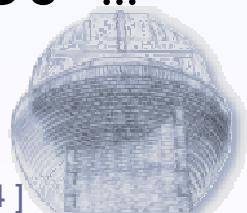
The second event



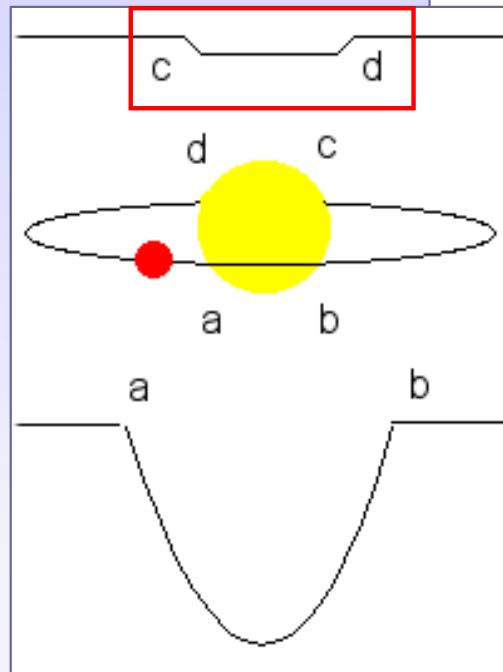
2009.12.25 - Corfini, Marchini, Zambelli

10.9 days after the first event

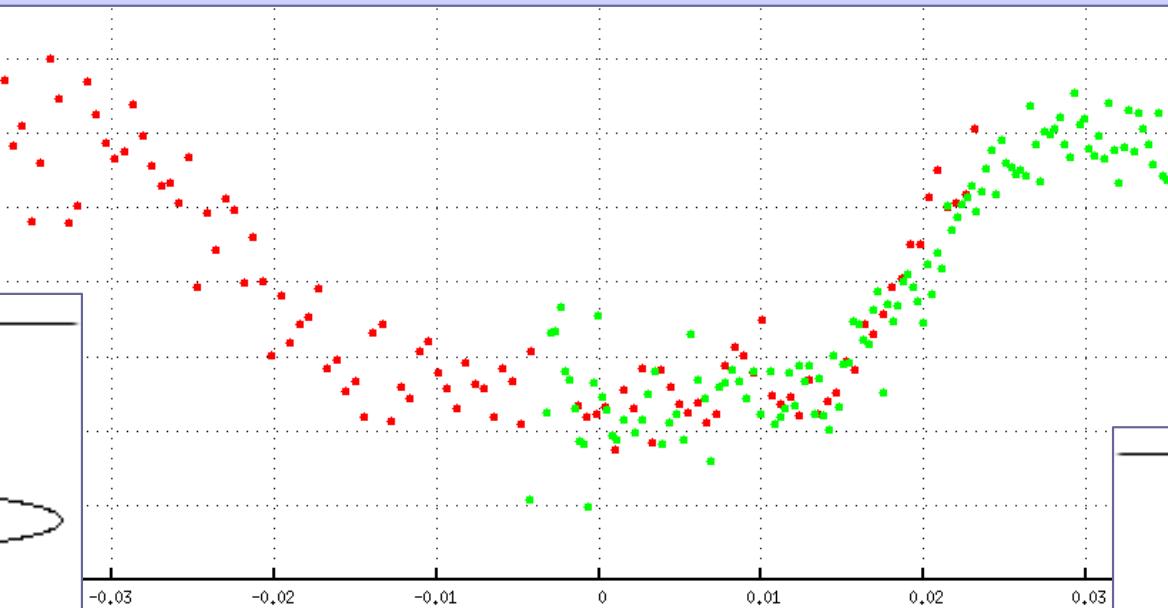
$$\frac{P}{10.9} \quad \frac{P/2}{5.45} \quad \frac{P/3}{3.63} \quad \frac{P/4}{2.73} \quad \frac{P/5}{2.18} \quad \frac{P/6}{1.82} \quad \frac{P/7}{1.56} \quad \frac{P/8}{1.36} \quad \dots$$



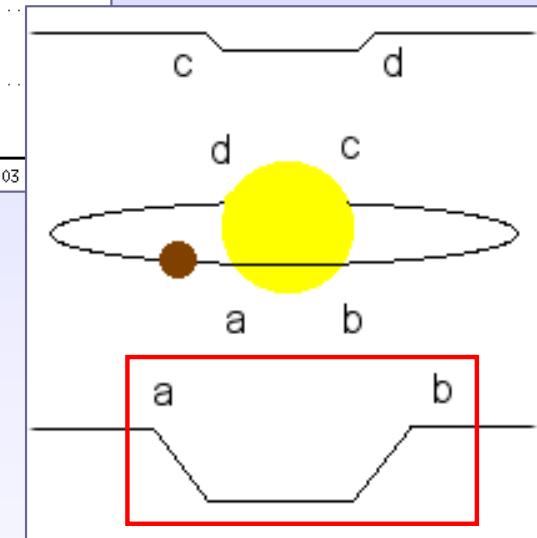
The first phasegraph of the event



red dwarf

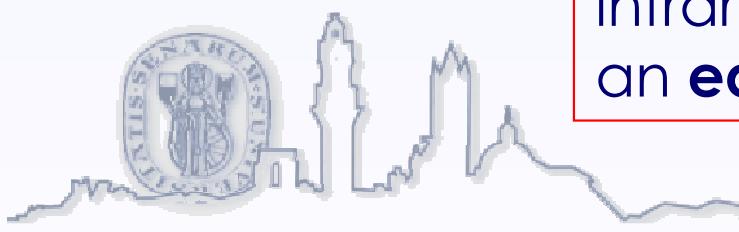


Duration ~ 4 hours
Depth ~ 35 mmag



brown dwarf

Primary star: optical and near infrared colors compatibles with an **early G type star**



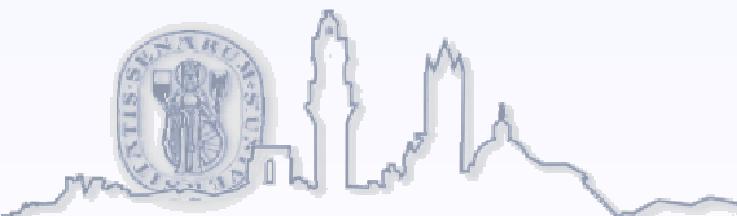
Observing...

candidate - runs										
	JD	Phase	Date	Observer	Band	Magn	Fluxes	Logb	Event	Notes
1	2455153	0.635	2009.11.17 mar	PPC	V	y	n	n	n	
2	2455156	0.558	2009.11.20 ven	PPC	V	y	n	n	n	
3	2455157	0.199	2009.11.21 sab	MMG	V	y	y	y	n	
4	2455174	0.096	2009.12.08 mar	MMG	V	y	y	y	n	
5	2455174	0.096	2009.12.08 mar	PPC	V	y	n	n	n	
6	2455176	0.378	2009.12.10 gio	MMG	V	y	y	y	n	
7	2455176	0.378	2009.12.10 gio	RAN	V	y	n	n	n	high rms
8	2455180	0.942	2009.12.14 lun	MMG	V	y	y	y	ph0.0	first event detected
9	2455185	0.148	2009.12.19 sab	MMG	V	y	y	y	n	
10	2455185	0.148	2009.12.19 sab	ZRO	L	y	y	y	n	
11	2455186	0.789	2009.12.20 dom	MMG	V	y	y	y	n	
12	2455186	0.789	2009.12.20 dom	PDM	g	y	n	y	n	high rms
13	2455186	0.789	2009.12.20 dom	RAN	V	y	n	n	n	high rms
14	2455191	0.994	2009.12.25 ven	CGI	L	y	y	y	ph0.0	
15	2455191	0.994	2009.12.25 ven	MXI	V	y	y	y	ph0.0	
16	2455191	0.994	2009.12.25 ven	ZRO	L	y	y	y	ph0.0	
17	2455193	0.276	2009.12.27 dom	MMG	B, I	y	y	y	n	
18	2455193	0.276	2009.12.							
19	2455193	0.276	2009.12.							

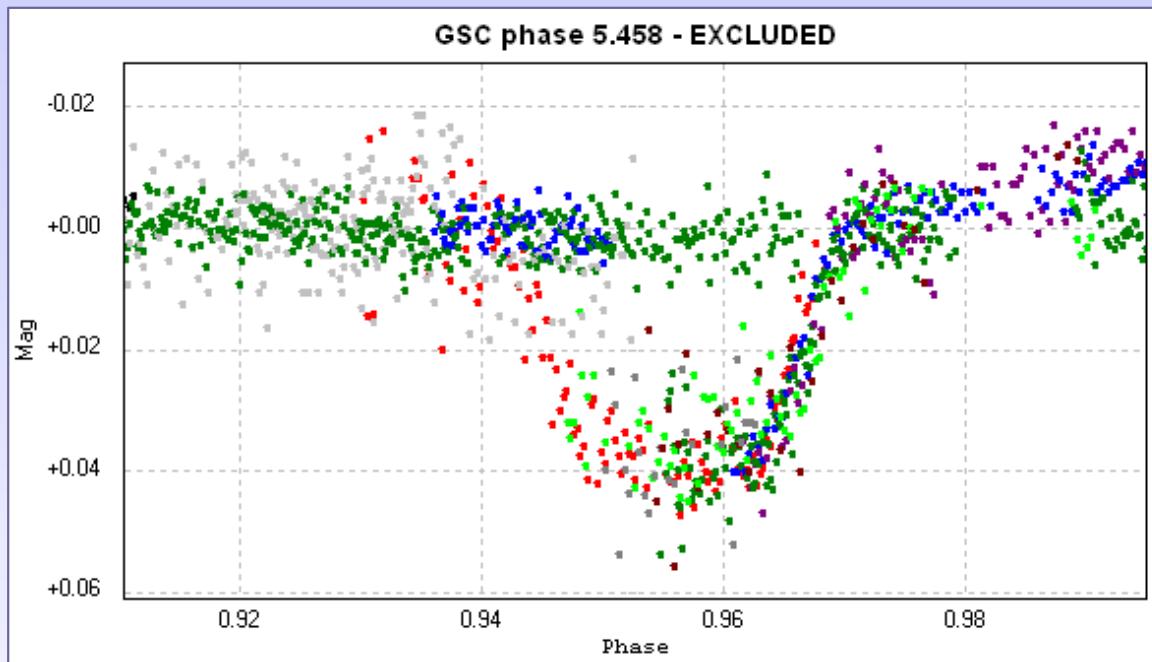
From 2009.11.17:

- 75 observing runs
- 12 observers
- more than 9000 photometric measurements

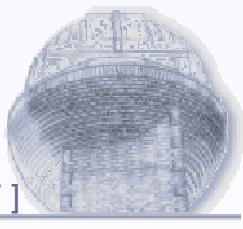
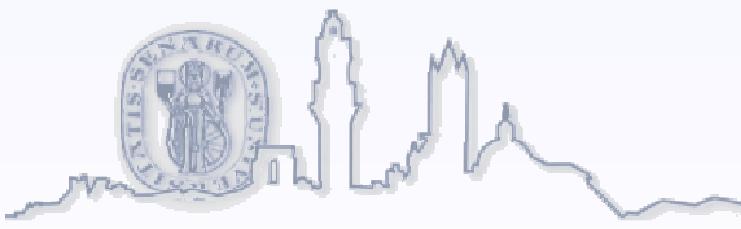
candidate - observers					
	color	ObsCode	Observer	Coord. (AR, Dec)	runs
1	green	arena	Arena, CT	+37 32 37, 15 03 18 E	4
2	purple	CGI	Corfini, LU	+43 47 34, 10 28 29 E	5
3	magenta	lopresti	Lopresti, SP	+44 07 20, 09 48 75 E	3
4	cyan	MQL	Mandelli, MI	+45 45 00, 09 13 00 E	3
5	green	MXI	Marchini, SI	+43 18 45, 11 20 12 E	11
6	brown	marino	Marino, CT	+37 32 37, 15 03 18 E	4
7	red	MMG	Martinengo, TO	+44 57 06, 07 19 31 E	16
		PIV	Pivetto, VI	+45 38 16, 11 12 36 E	1
8	black	PPC	Papini, FI	+43 40 52, 11 10 09 E	4
9	grey	PDM	Perrotta, CS	+39 25 51, 16 14 23 E	3
10		RAN	Ruocco, NA	+40 37 07, 14 21 27 E +37 63, 15 07 E (skylive)	12
11	dark blue	SAH	Samolyk, USA	+33, 106 W (new mexico)	1
12	blue	ZRO	Zambelli, SP	+44 06 17, 10 00 29 E	7
total runs					74



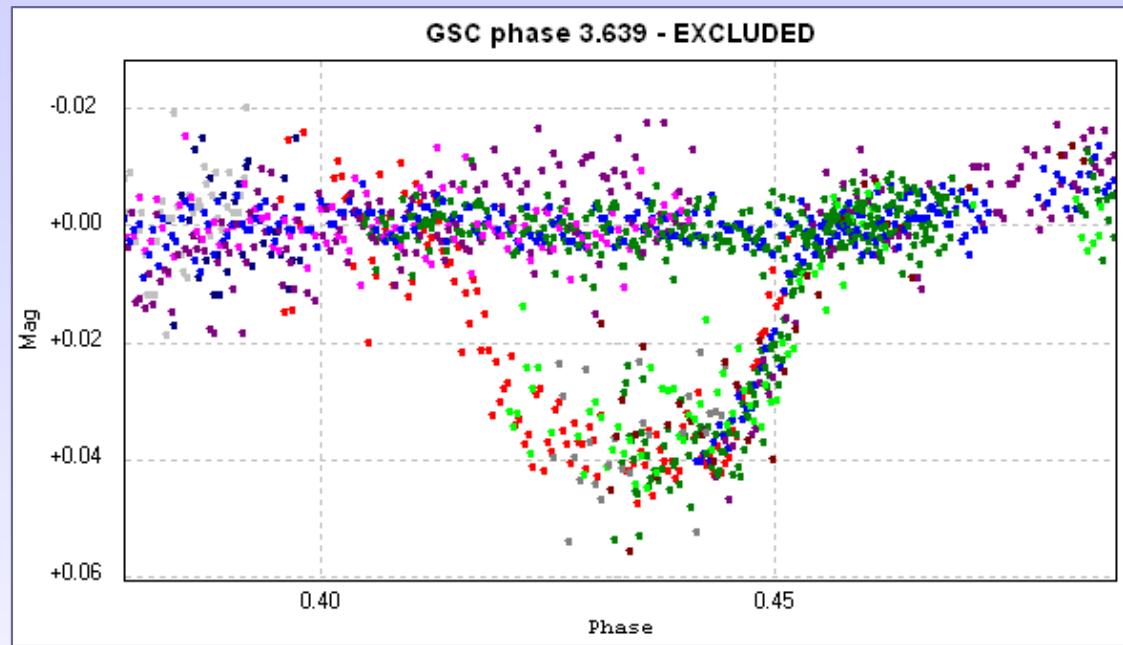
Observing...



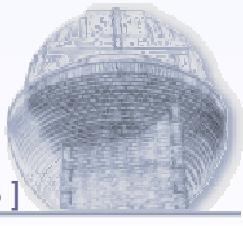
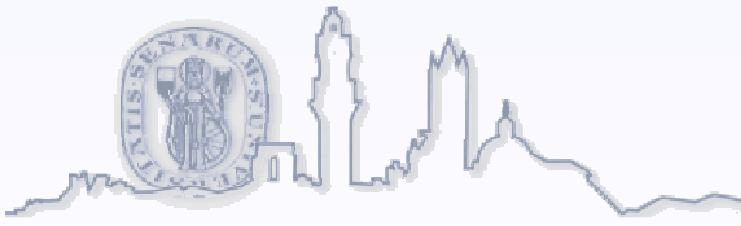
P	$P/2$	$P/3$	$P/4$	$P/5$	$P/6$	$P/7$	$P/8$...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



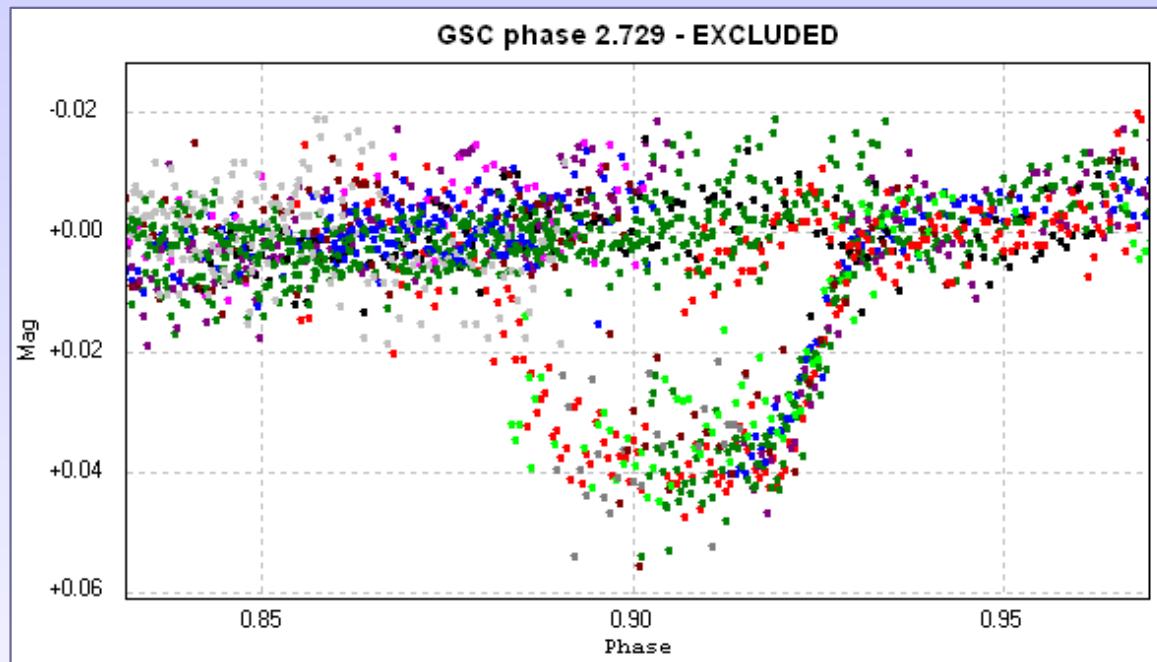
Observing...



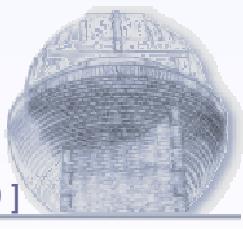
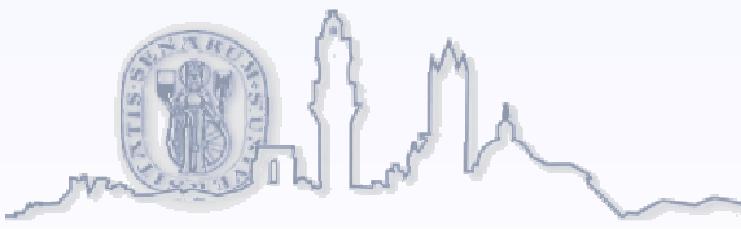
P	$P/2$	$P/3$	$P/4$	$P/5$	$P/6$	$P/7$	$P/8$...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



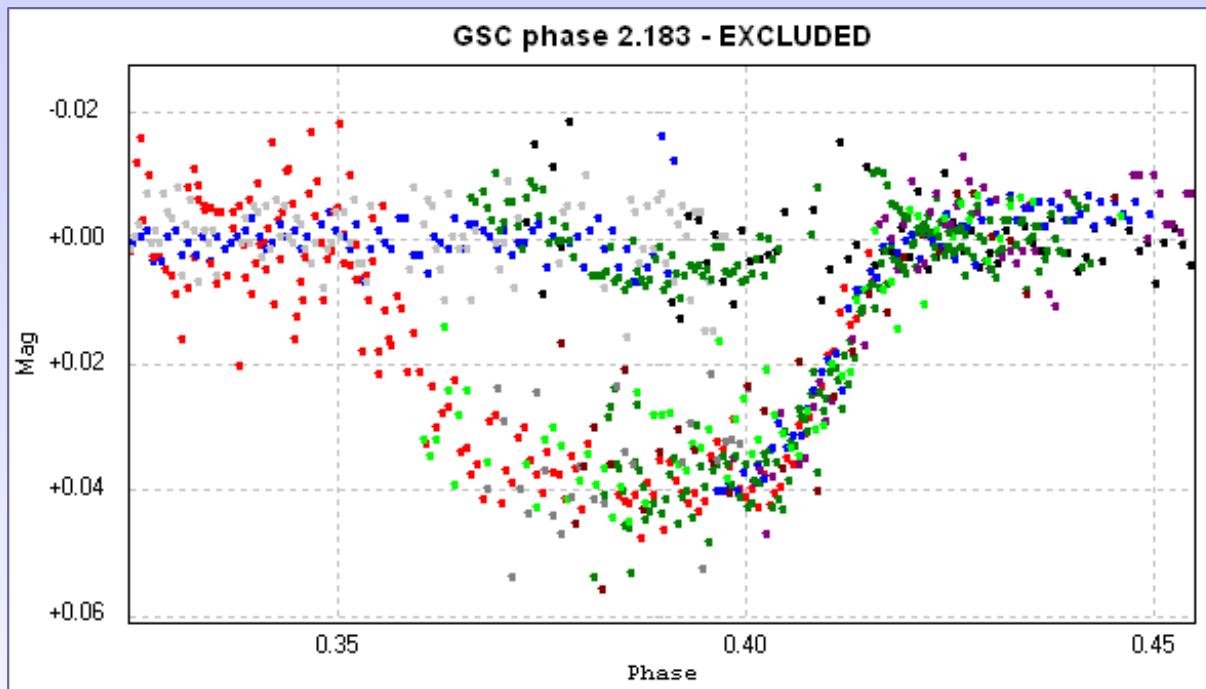
Observing...



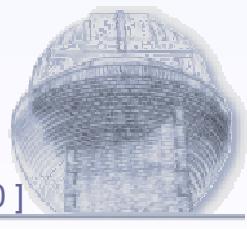
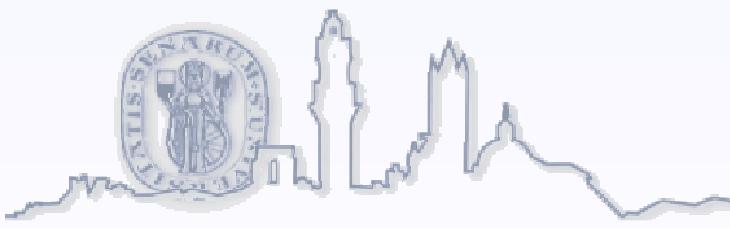
P	$P/2$	$P/3$	$P/4$	$P/5$	$P/6$	$P/7$	$P/8$...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



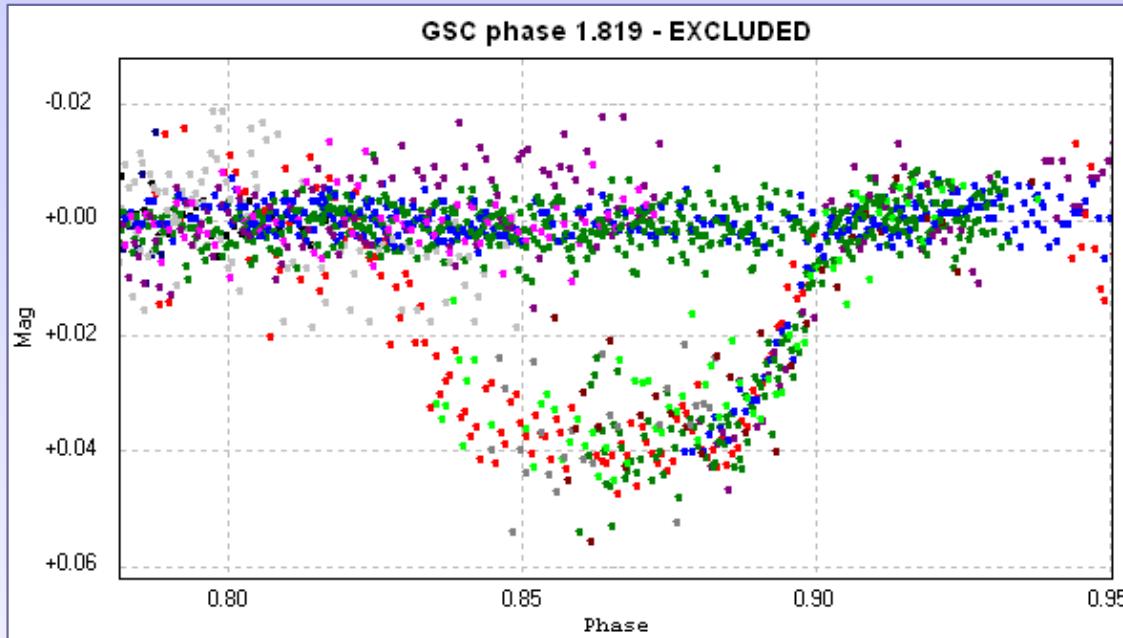
Observing...



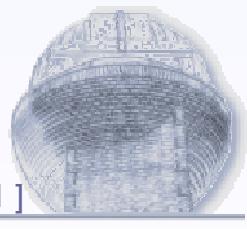
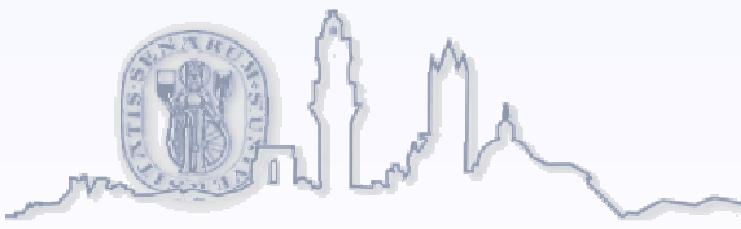
P	$P/2$	$P/3$	$P/4$	$P/5$	$P/6$	$P/7$	$P/8$...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



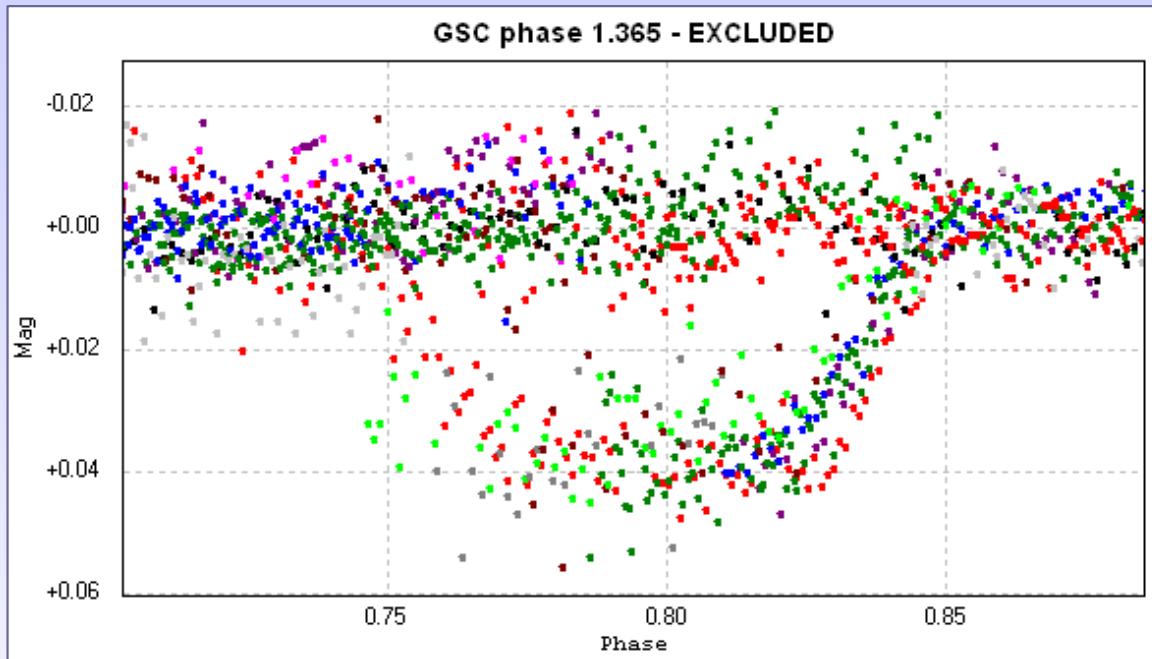
Observing...



<u>P</u>	P/2	P/3	P/4	P/5	P/6	P/7	P/8	...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



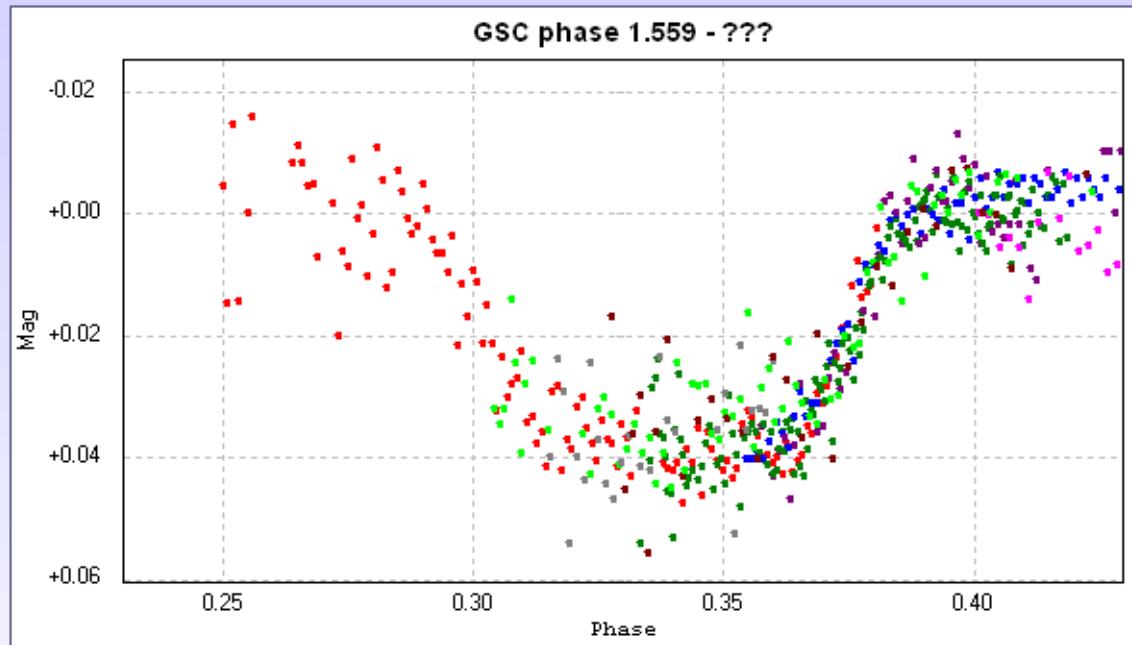
Observing...



<u>P</u>	P/2	P/3	P/4	P/5	P/6	P/7	P/8	...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



Observing...



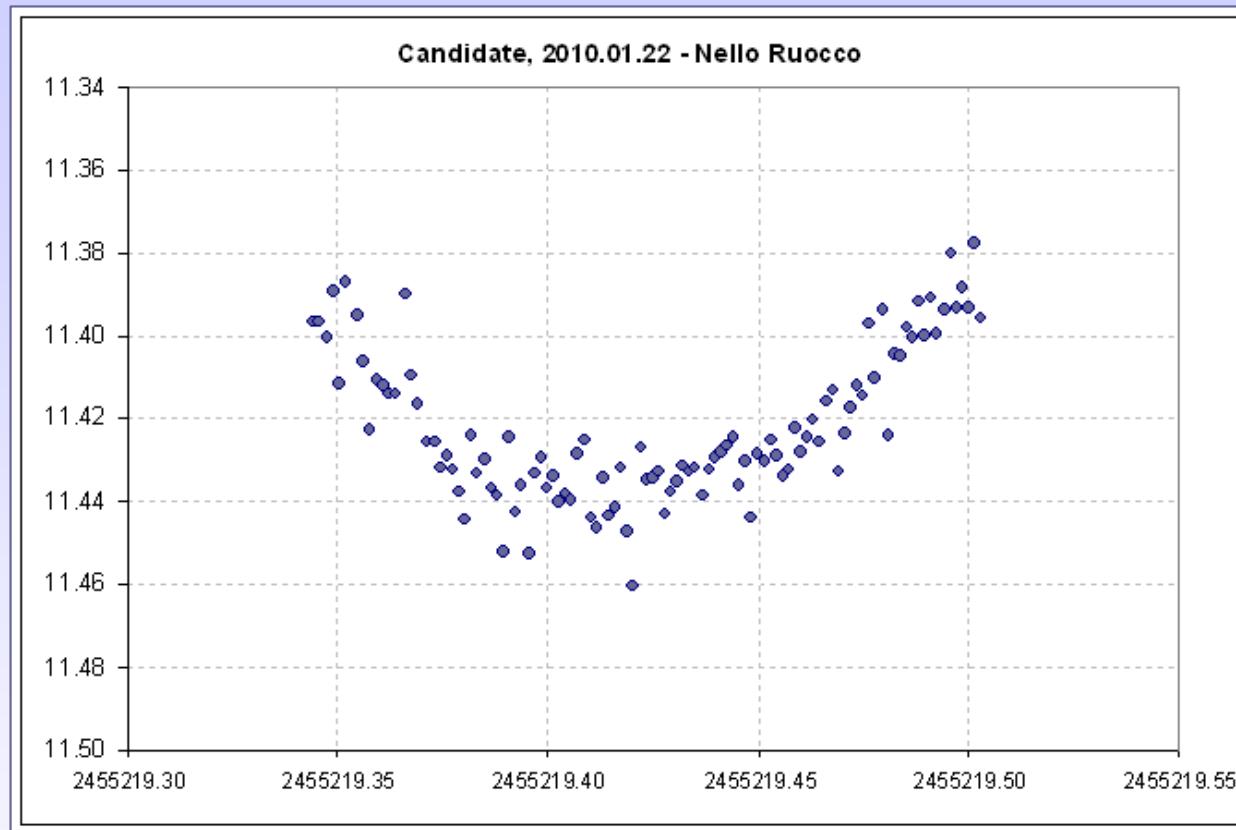
<u>P</u>	P/2	P/3	P/4	P/5	P/6	<u>P/7</u>	P/8	...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



?



Observing... Nello Ruocco, 2010.01.22!



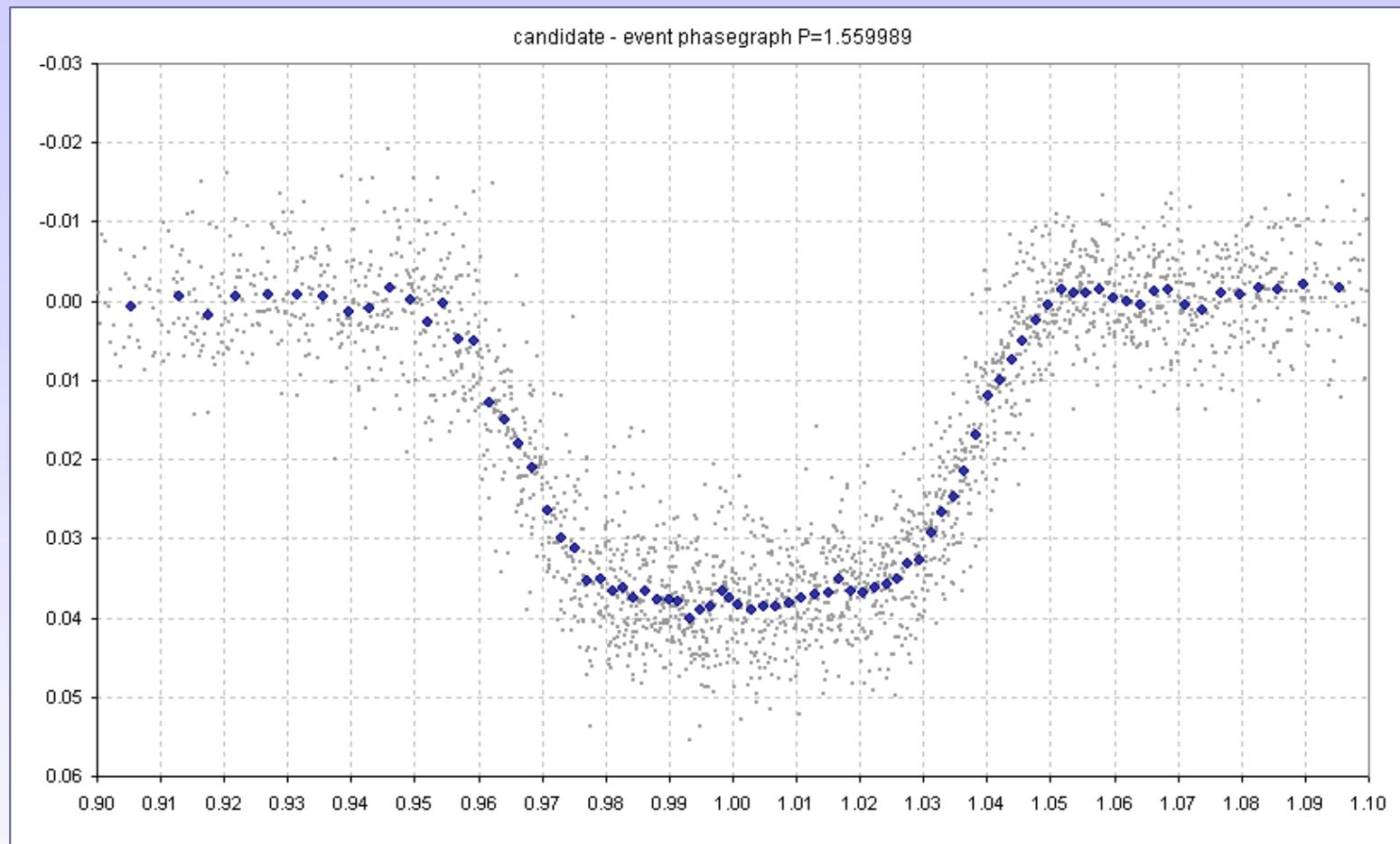
P	$P/2$	$P/3$	$P/4$	$P/5$	$P/6$	$\underline{P/7}$	$P/8$...
10.9	5.45	3.63	2.73	2.18	1.82	1.56	1.36	...



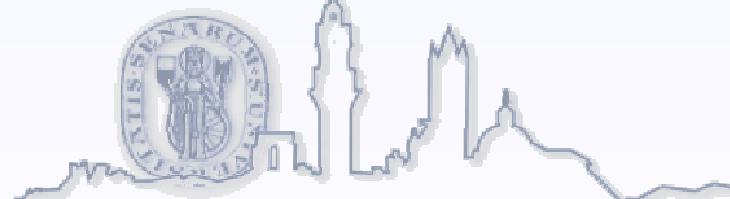
!



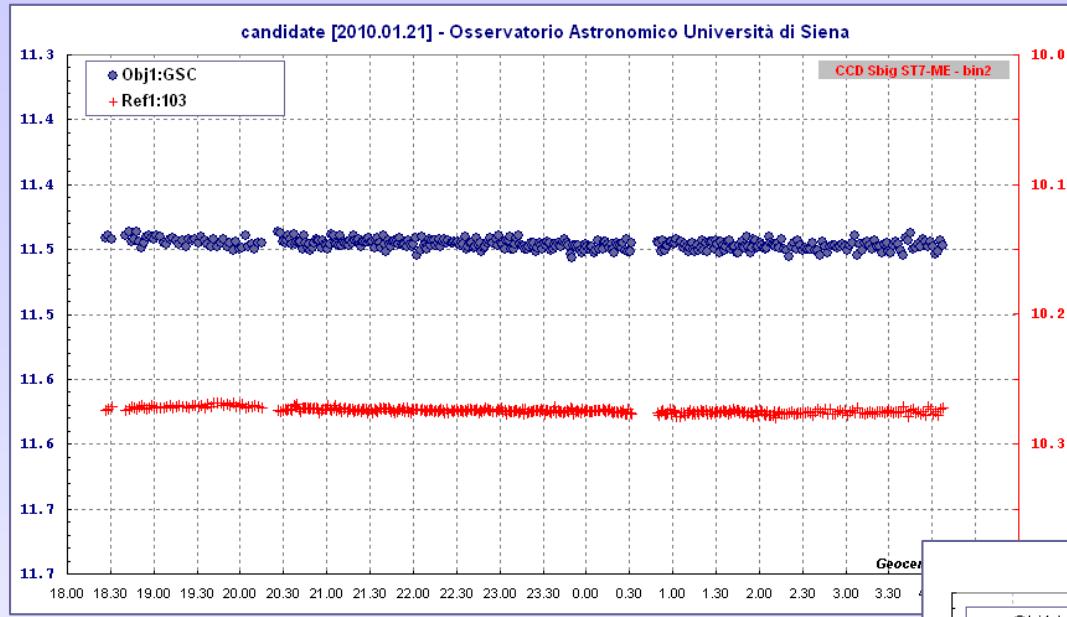
Observing... Period=1.56 d



P	$P/2$	$P/3$	$P/4$	$P/5$	$P/6$	$\frac{P/7}{1.56}$	$P/8$...
10.9	5.45	3.63	2.73	2.18	1.82	$\frac{P/7}{1.56}$	1.36	...

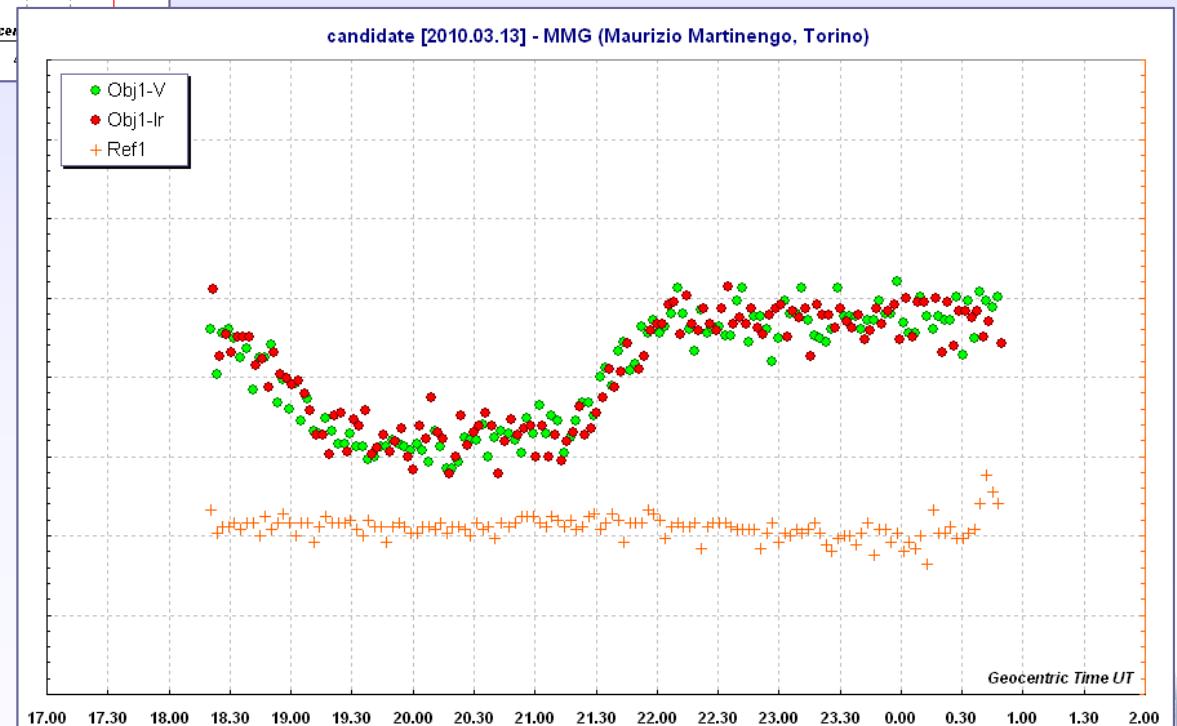


Observing...



2010.01.21: no event

rms=3.2 mmag on candidate

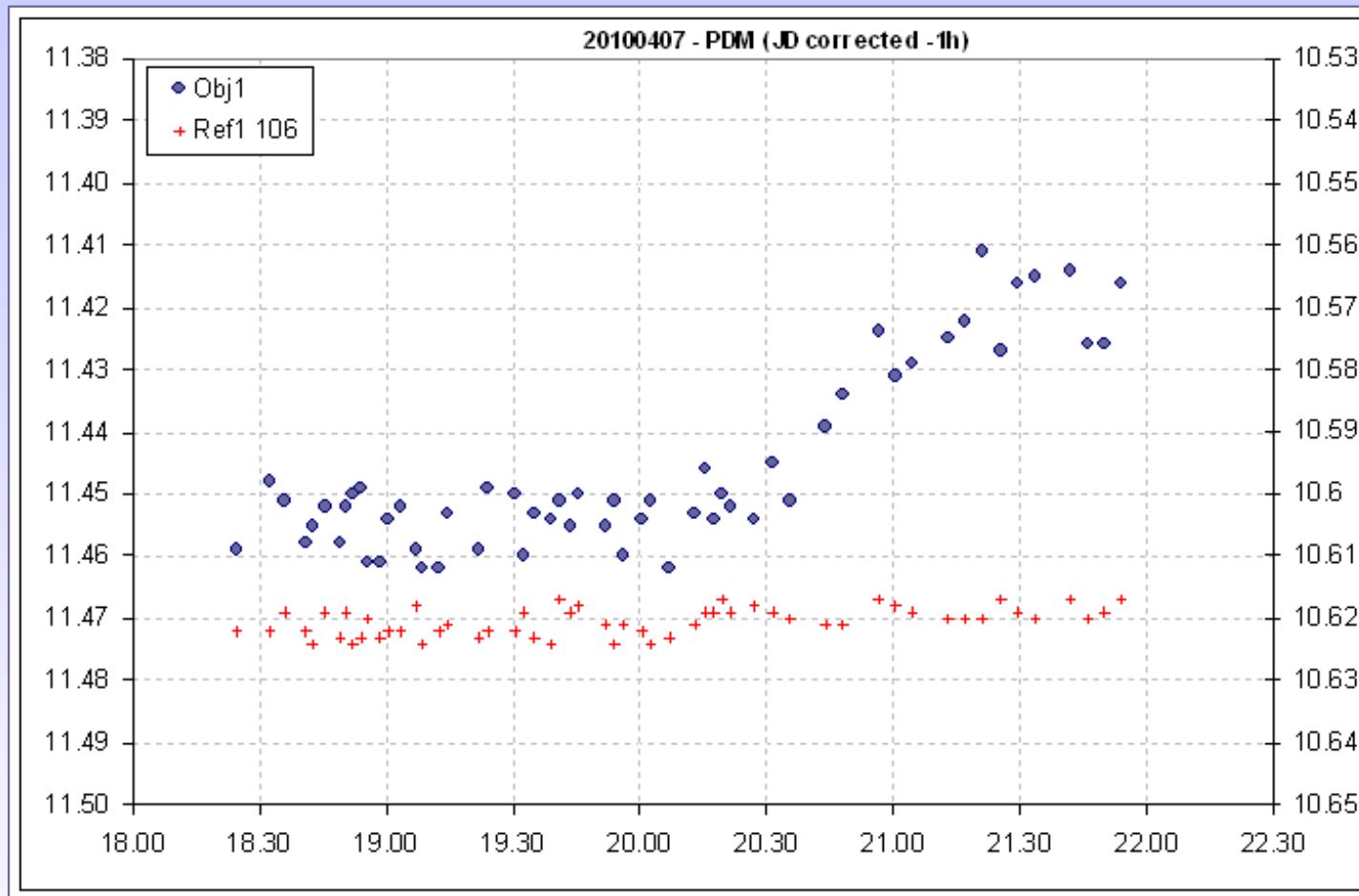


2010.03.13: event observed
in V and Ir band

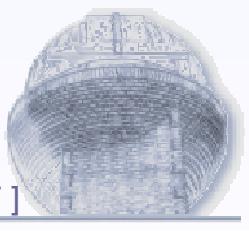
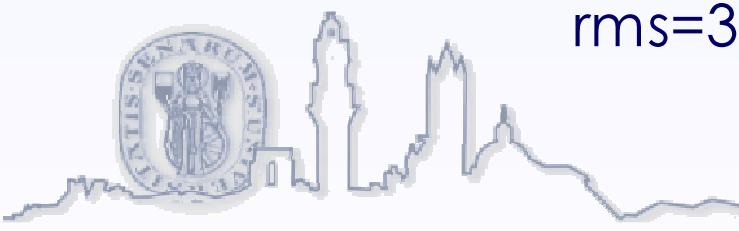
rms=5.2 mmag
on combined refs



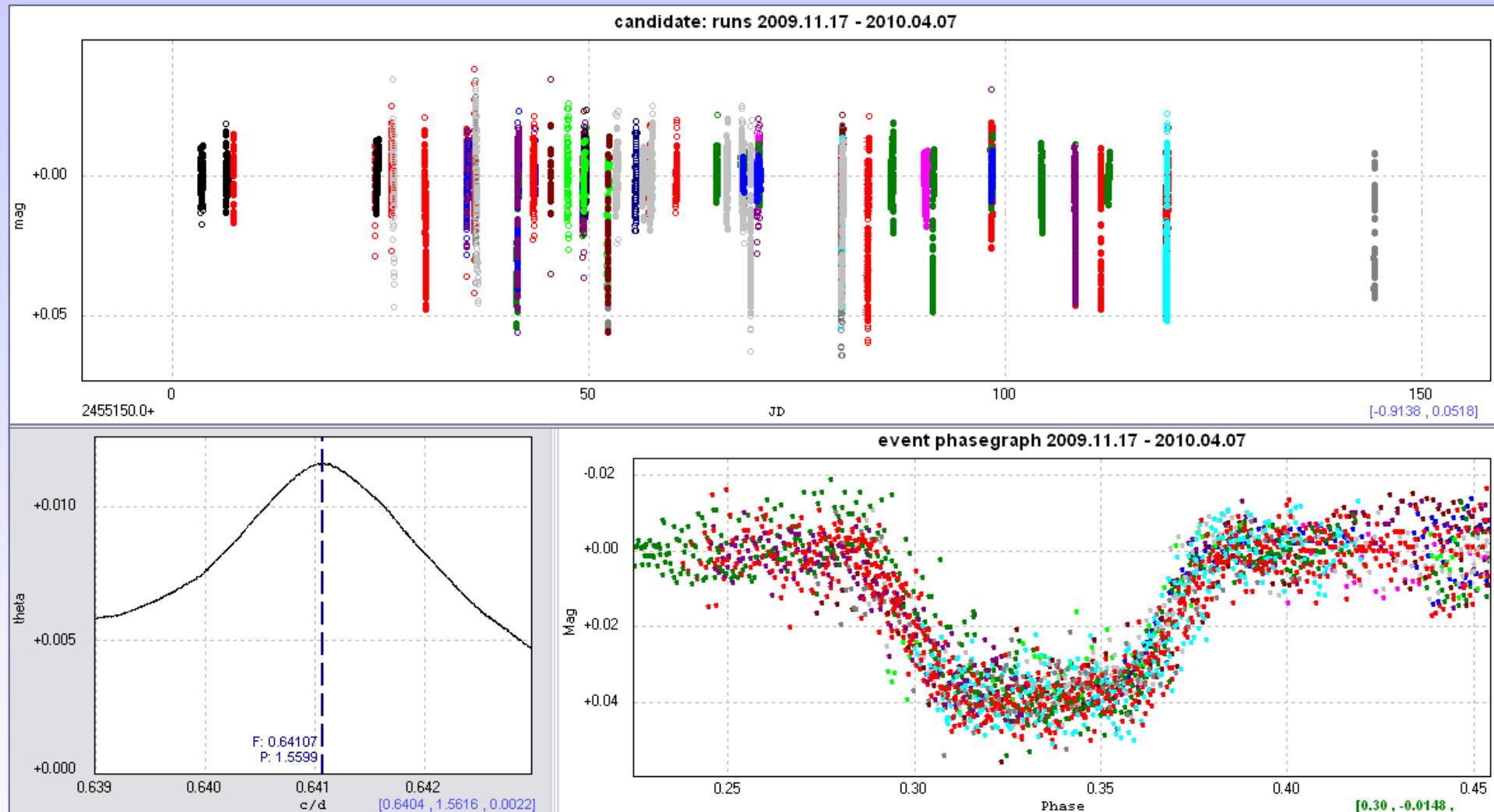
Observing...



2010.04.07: last event detected
Damiano Perrotta
rms=3.8 mmag on 3 combined refs



Analysis...

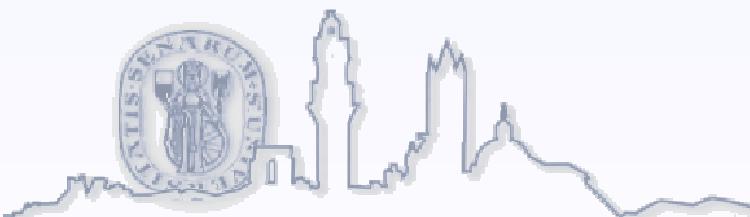
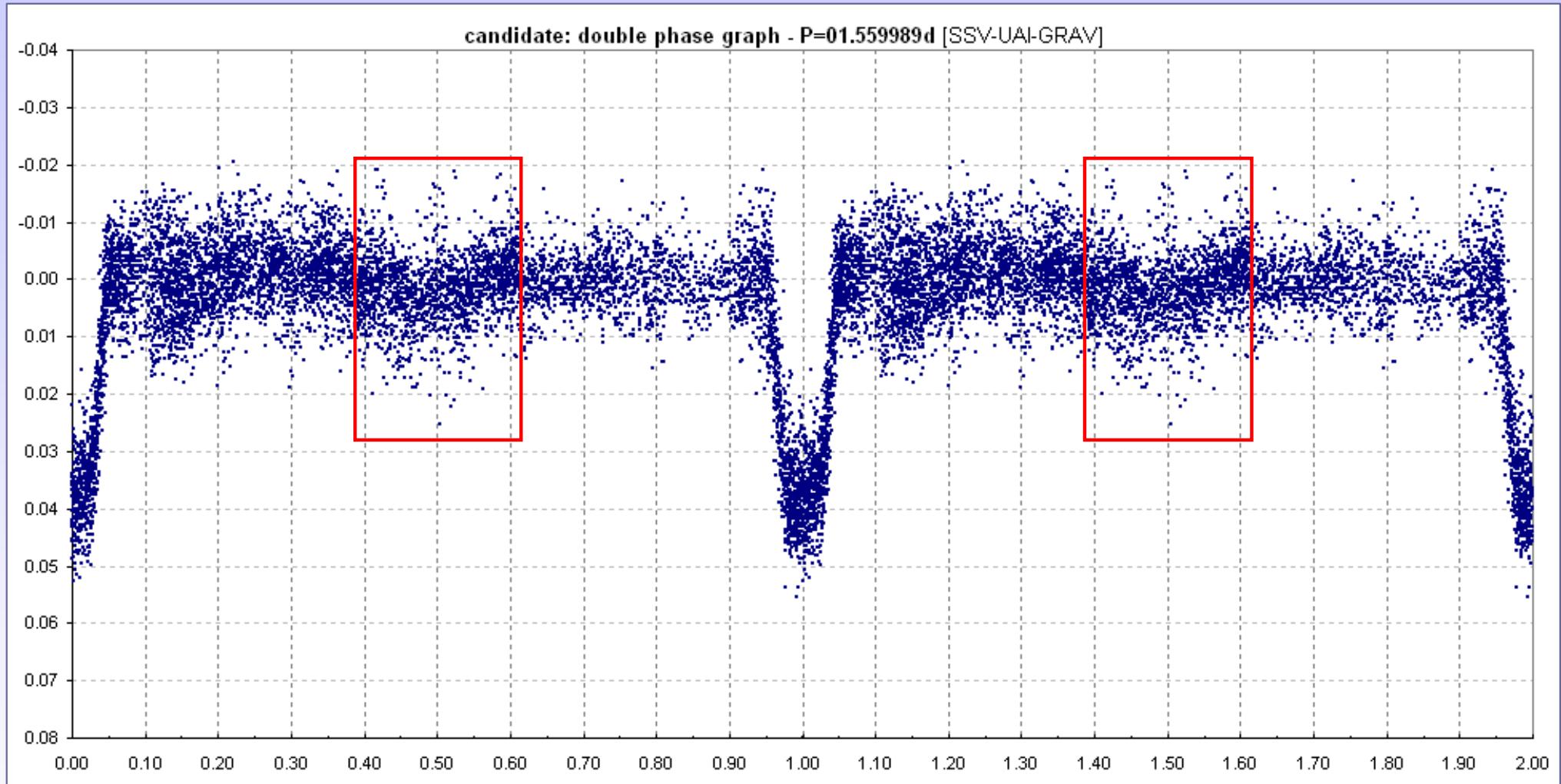


From 2009.11.14 to 2010.04.07: 75 observing runs

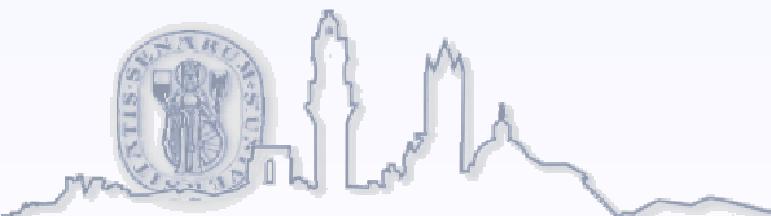
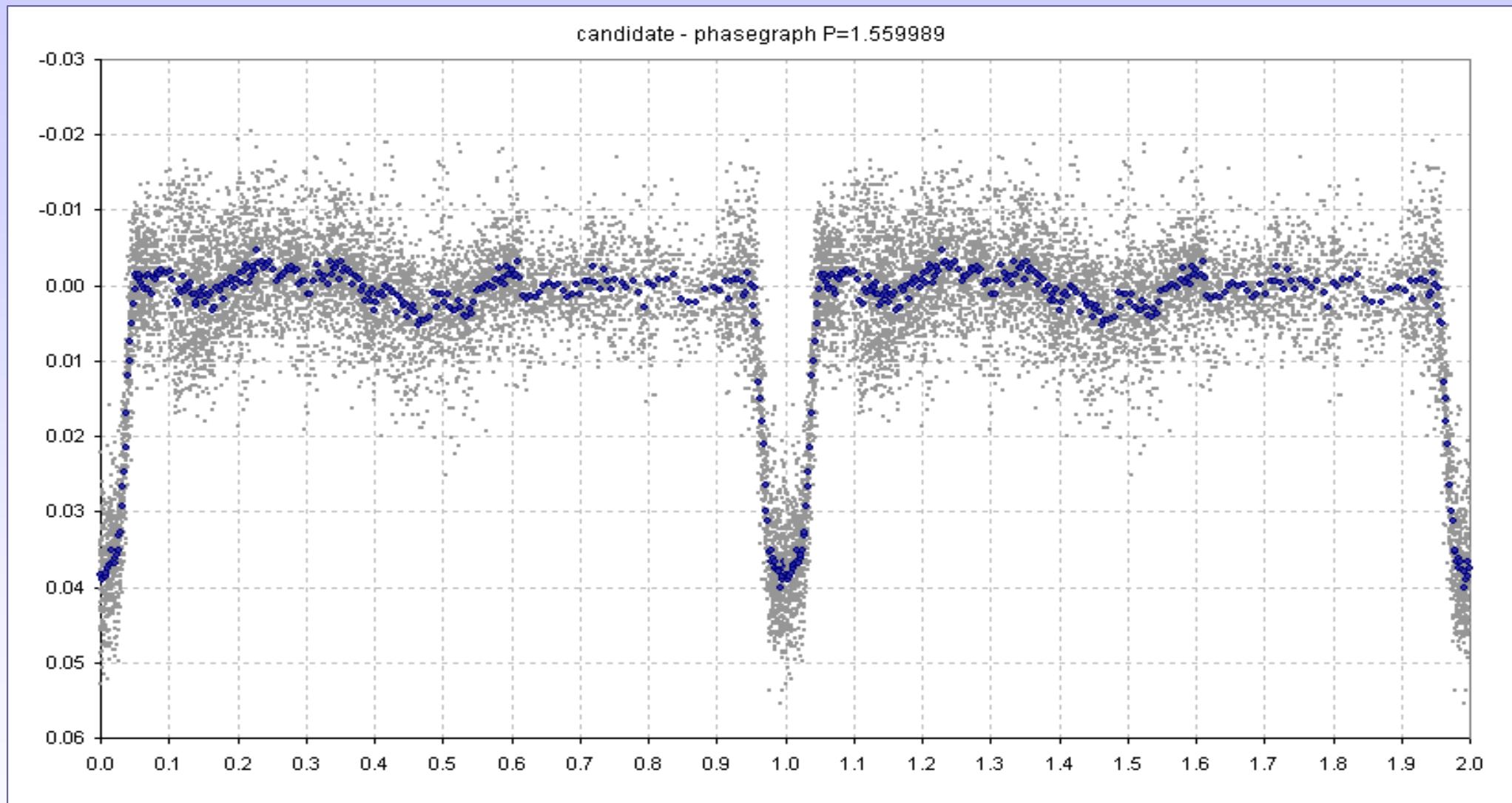
F = 0.64107 Period = 1.559989



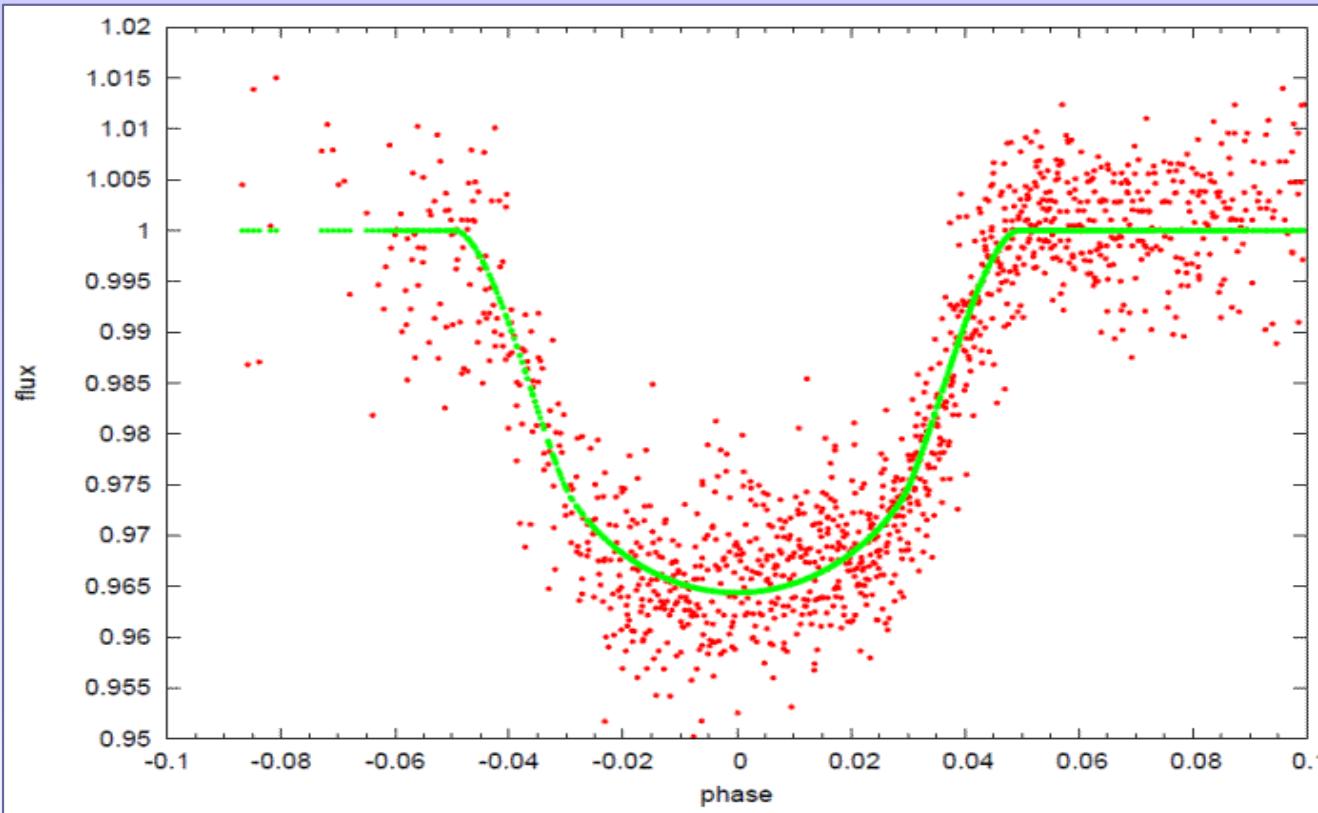
Analysis: phasegraph



Analysis: binned phasegraph



First results



Fitted parameters:

1.559989 period [days]

3.7 **eclipse duration [hours]**

81.1 **inclination [deg]**

0.534 **impact parameter**

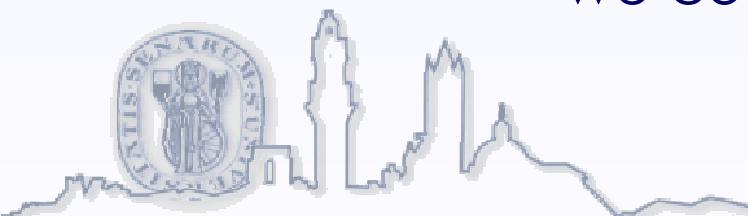
0.174248 R_2/R_1

0.03036 $\Delta L/L$

0.32 **dens. primary [g/cm³]**

1.85 χ^2

With radial velocity measurements
we could better describe the system



The zero-point problem

- Le osservazioni provenienti da 12 diversi osservatori erano state raccolte con setup strumentali differenti, in più bande, usando stelle di riferimento a volte diverse.
- In fase di analisi, l'allineamento dei dati fotometrici, eseguito a mano (o meglio "a occhio"), ha richiesto un notevole dispendio di tempo, ed era comunque soggettivo.
- Per il futuro abbiamo pensato di delegare gli stessi osservatori al lavoro di allineamento delle singole curve, attraverso una procedura di "normalizzazione" assistita.



The normalizer

- Si tratta di un foglio di calcolo, privo di macro, funzionante con Ms Excel ma anche con programmi free come Gnumeric o OO-Calc, che assiste l'osservatore nella selezione dei punti sicuramente fuori evento per determinare lo zero-point nei dati.

NORMALIZER

- Il foglio, che potrà essere usato anche su altri target (binarie a eclissi o esopianeti), permetterà agli osservatori l'invio dei dati già normalizzati ai responsabili della raccolta delle osservazioni.

