

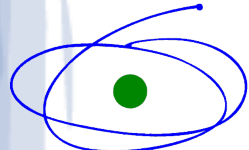
Astrometry and Stellar Occultations of Irregular Satellites



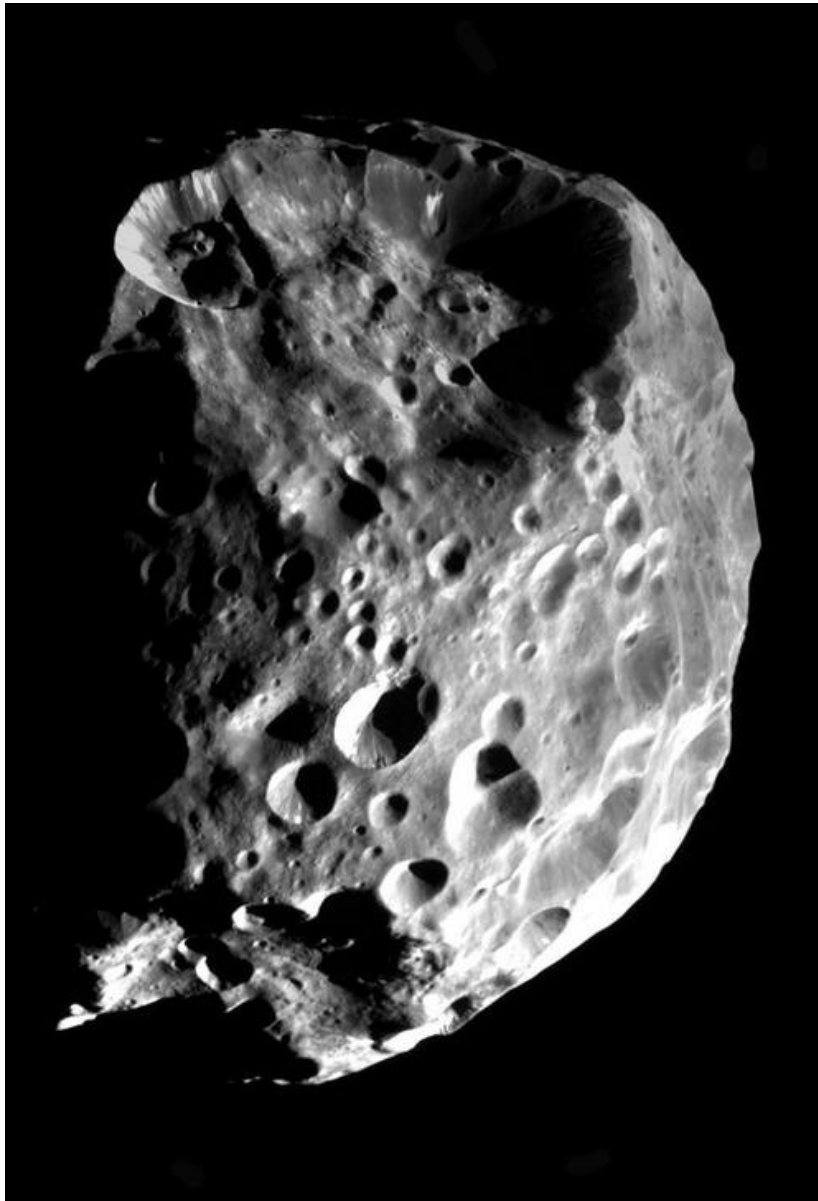
Astronomia
Pós-Graduação
UFRJ



Observatório
do Valongo



C A P E S



Phoebe (*Cassini*)

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Roberto Vieira Martins (ON)

Júlio Ignácio Bueno de Camargo (ON)

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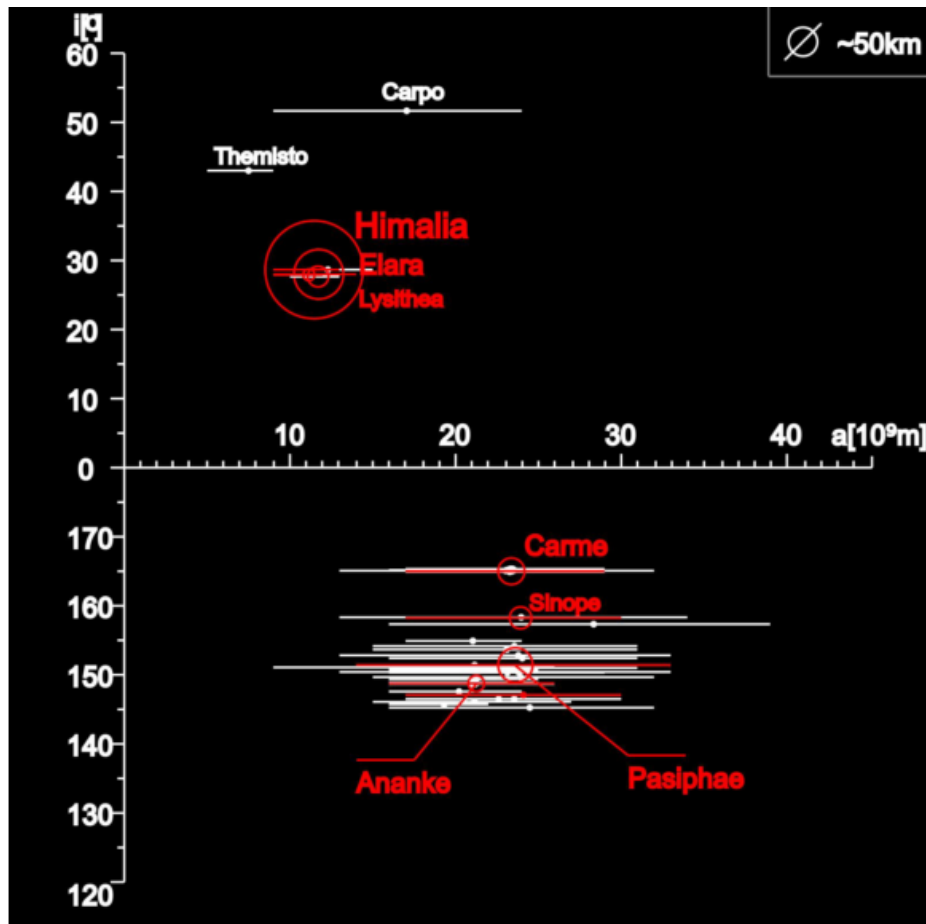
Felipe Braga Ribas (ON)

Bruno Eduardo Morgado (ON)

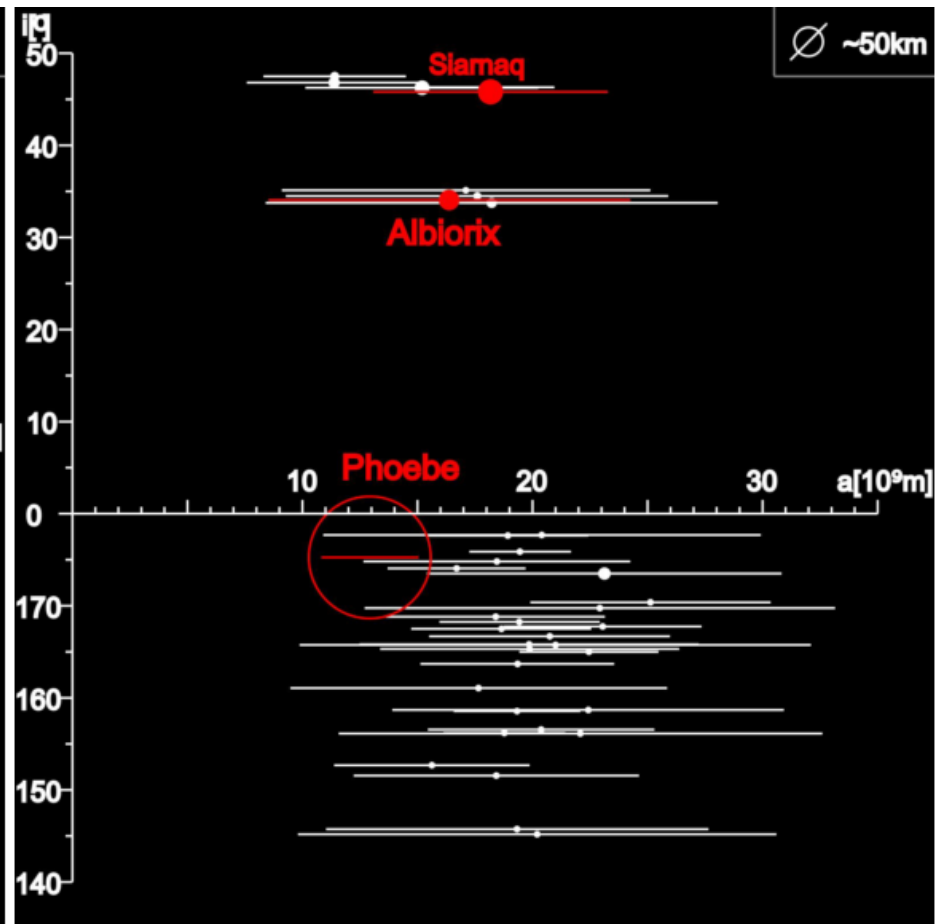
Alex Dias Oliveira (ON)

Gustavo Benedetti Rossi (ON)

Irregular Satellites



Satellites of Jupiter



Satellites of Saturn

Irregular Satellites

- Probably captured by giant planets;
- Possible common origin to the Trans-Neptunian Objects (Jewitt et al., 2007);
- Only Himalia, Phoebe e Nereida were observed by spacecrafts;
- Researchs show that the irregular satellites have similar colors to the C-, D- and P- type of asteroids, Centaurs or TNOs.

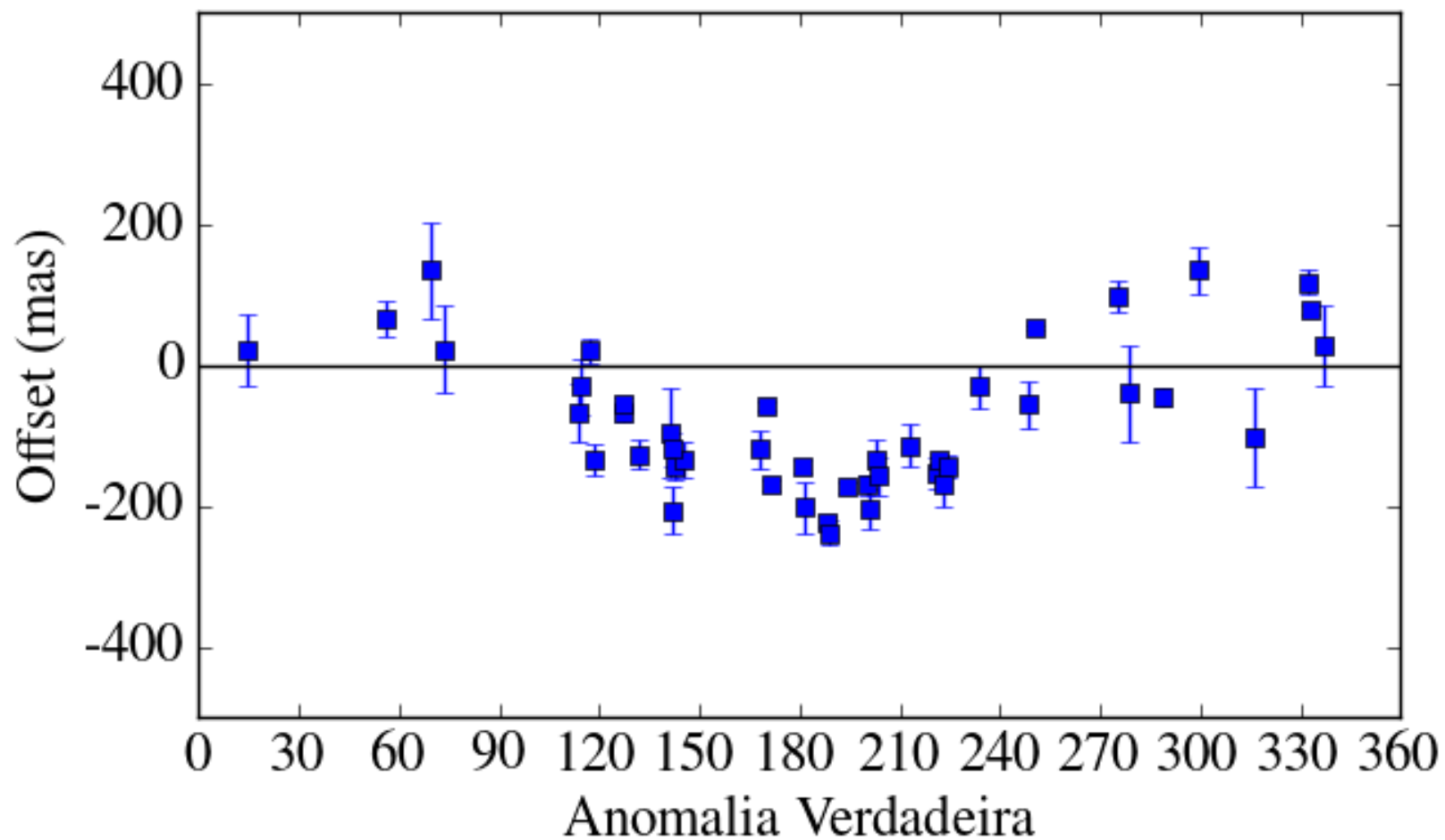
Astrometry

- Observations made at OPD, ESO and OHP between 1992 and 2014;
- 3 sites, 5 telescopes, more than 10 cameras and more than 10 filters;
- More than 8000 identified positions where 6523 were selected as good positions.

Results

Satélite	Diâm. (km) ³	Mag V	OPD	OHP	ESO	Total	Jacobson
Himalia	170	14	854	357	23	1234	1757
Elara	86	16	403	187	46	636	1115
Lysithea	36	18	60	84	90	234	431
Leda	20	19	6	48	44	98	178
Pasiphae	60	17	295	248	66	609	1629
Callirrhoe	9	21	9	-	16	25	95
Megaclite	5	22	-	-	10	10	50
Ananke	28	18	52	141	57	250	600
Praxidike	7	21	-	-	2	2	59
Carme	46	18	90	204	37	331	973
Sinope	38	18	41	169	11	221	854
Themisto	8	21	-	-	16	16	55
Phoebe	213	16	1239	516	32	1787	3479
Siarnaq	40	20	-	20	56	76	239
Paaliaq	22	21	-	-	11	11	82
Albiorix	32	20	-	-	46	46	137
Sycorax	150	21	-	-	35	35	237
Nereid	340	19	803	-	99	902	716

Results - Carme



Results

A&A 580, A76 (2015)

DOI: [10.1051/0004-6361/201526273](https://doi.org/10.1051/0004-6361/201526273)

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**Astronomy
&
Astrophysics**

Astrometric positions for 18 irregular satellites of giant planets from 23 years of observations★,★★,★★★,★★★★

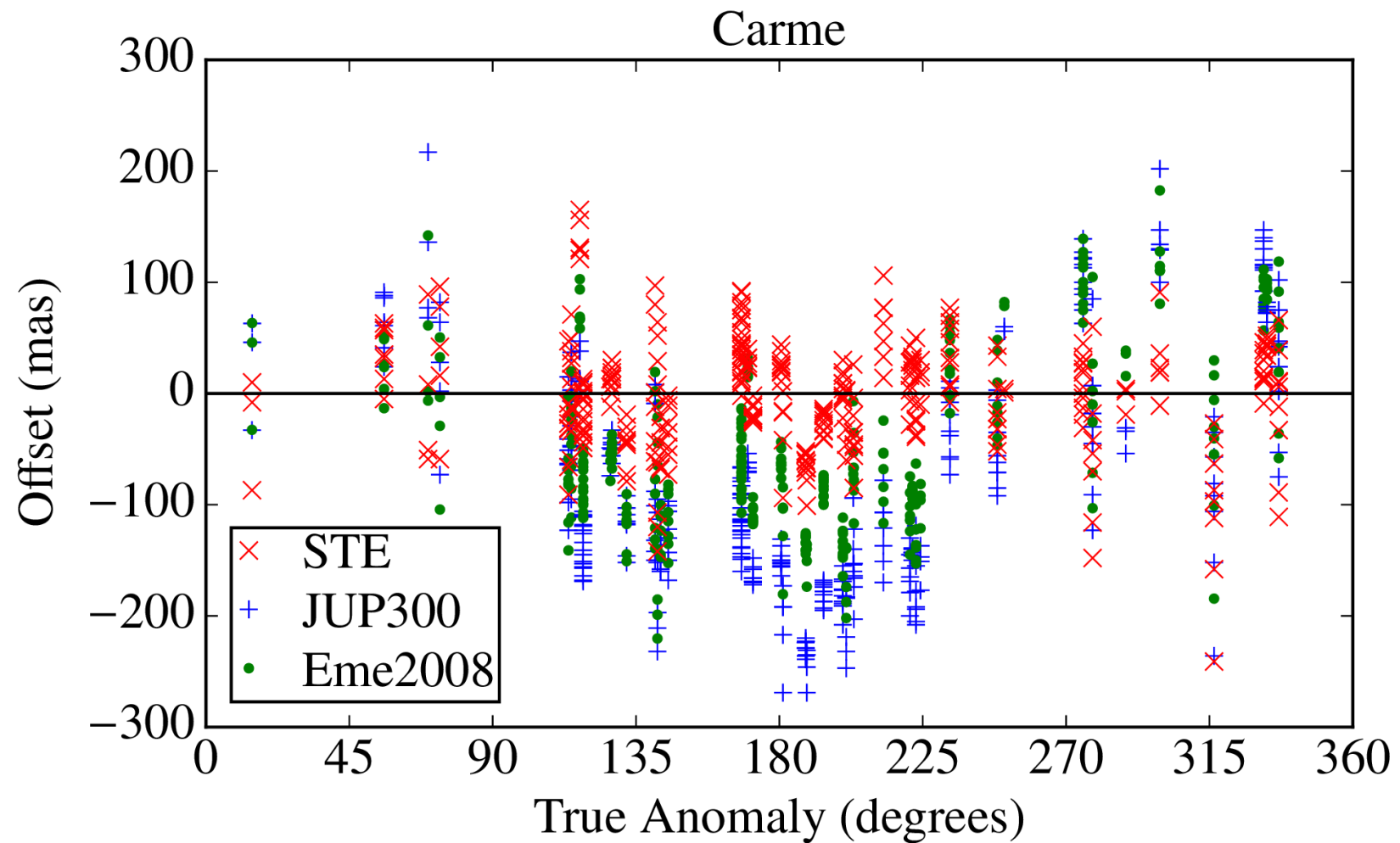
A. R. Gomes-Júnior¹, M. Assafin^{1,4}, R. Vieira-Martins^{1,2,3,4}, J.-E. Arlot⁴, J. I. B. Camargo^{2,3}, F. Braga-Ribas^{2,5},
D. N. da Silva Neto⁶, A. H. Andrei^{1,2,4}, A. Dias-Oliveira², B. E. Morgado¹, G. Benedetti-Rossi², Y. Duchemin^{4,7},
J. Desmars⁴, V. Lainey⁴, and W. Thuillot⁴

Stellar Occultations of Irregular Satellites

Predictions

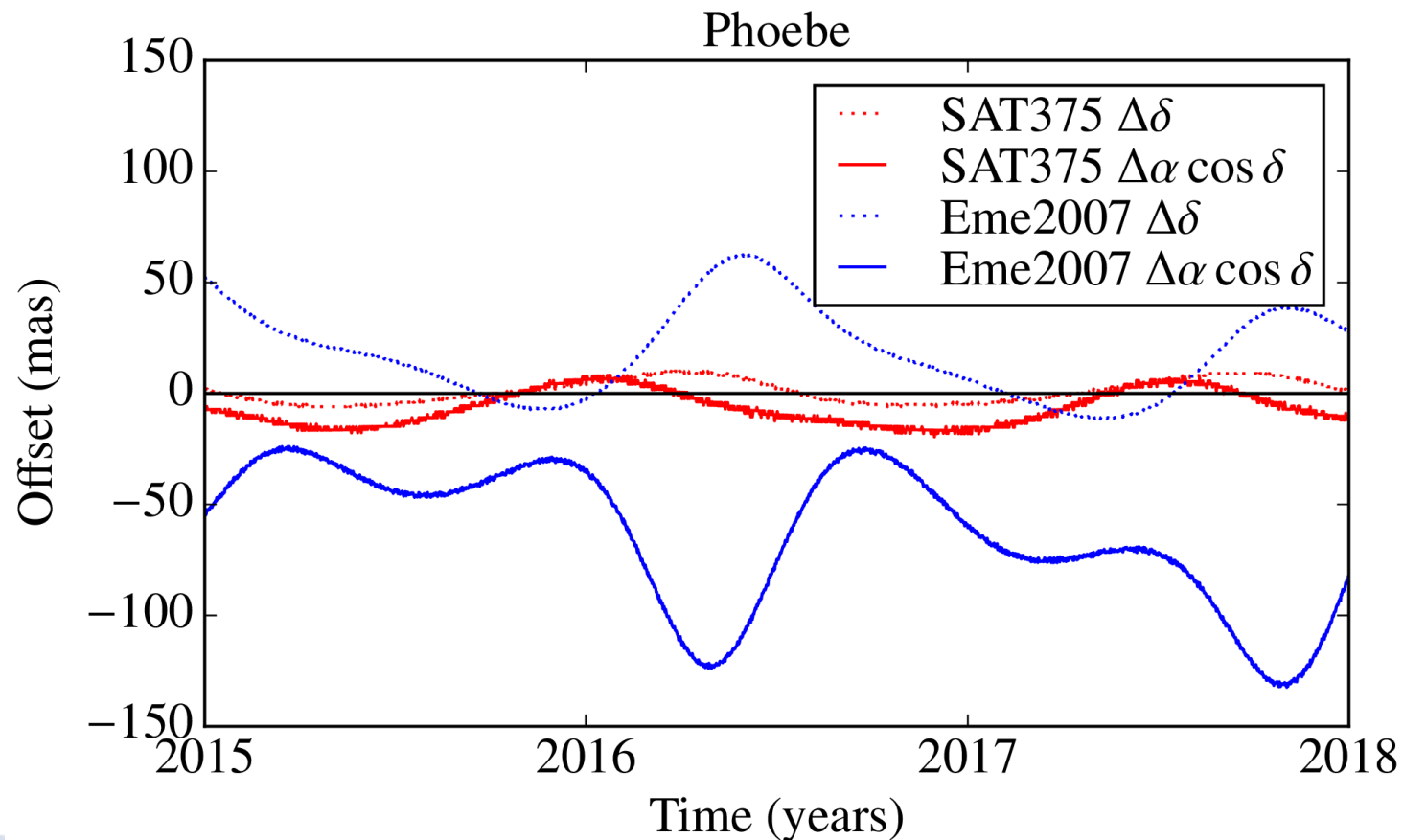
- Prediction of occultations for 8 satellites of Jupiter (Himalia, Elara, Pasiphae, Sinope, Lysithea, Carme, Ananke e Leda), Phoebe, Nereid e Triton;
- Stars of the UCAC4 catalogue and, for Triton and Nereid, the WFI catalogue;
- 396 events identified between January 2016 and December 2017.

Ephemeris of the Jovian satellites (STE)

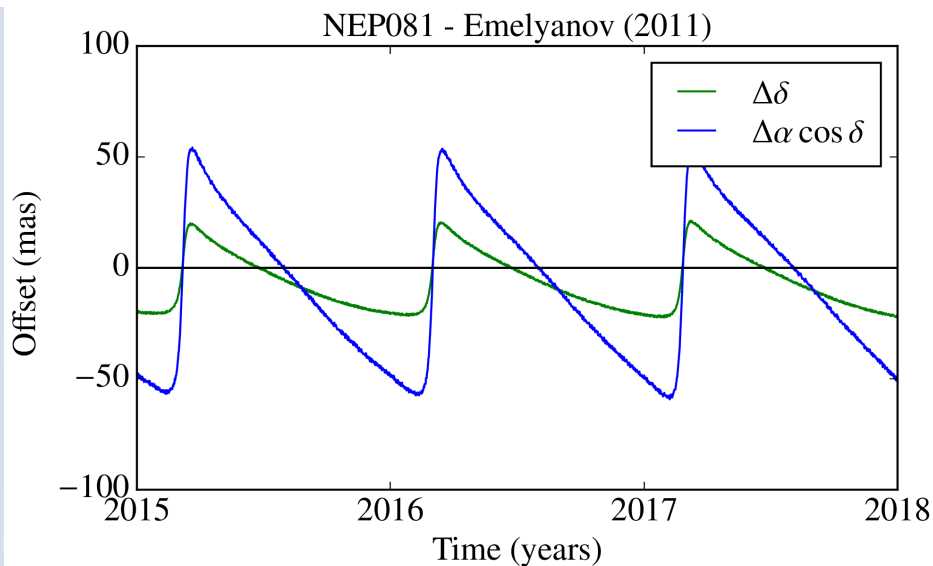
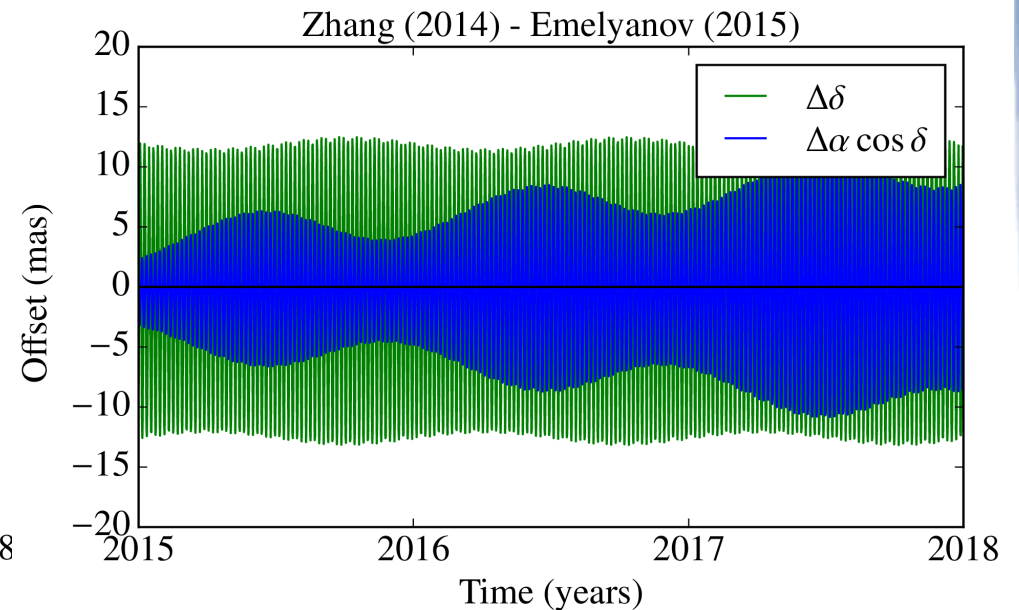
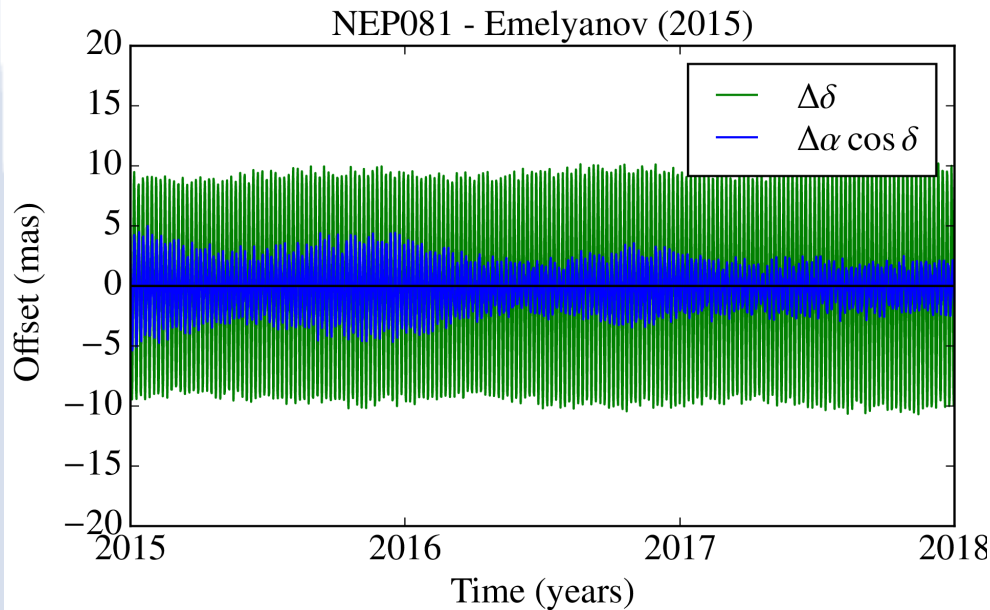


Phoebe's orbit from ground-based and space-based observations^{★,★★}

J. Desmars^{1,2}, S. N. Li^{1,2,3}, R. Tajeddine^{2,4}, Q. Y. Peng⁵, and Z. H. Tang¹



Ephemeris of Triton and Nereid



- Triton: Emelyanov et al. (2015)
- Nereid: Emelyanov et al. (2011)

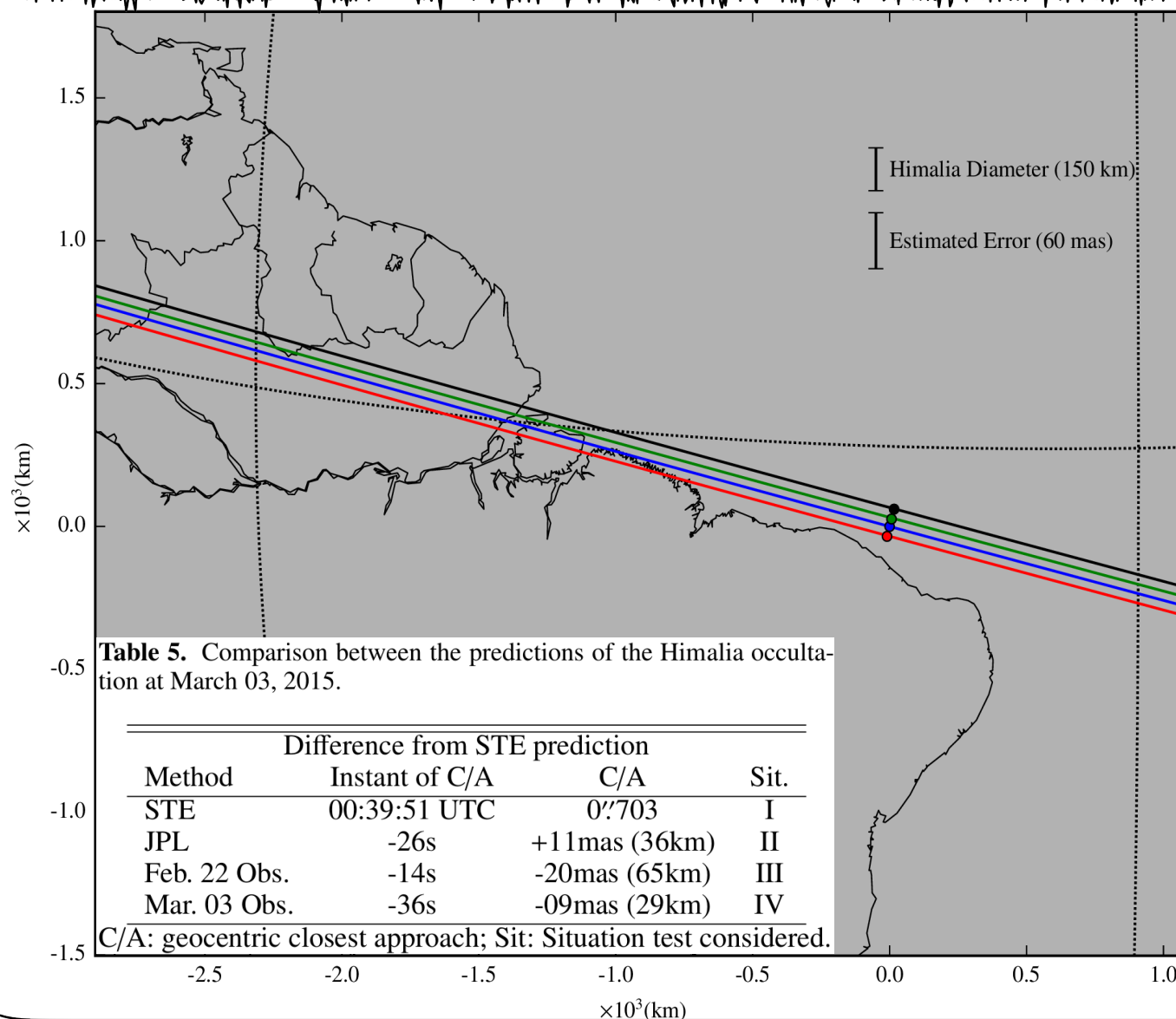
Predictions

Table 3. Number of stellar occultations for each satellite from January, 2016 up to December, 2017.

Satellite	2016	2017	Total
Ananke	12	16	28
Carme	20	14	34
Elara	14	16	30
Himalia	15	12	27
Leda	8	24	32
Lysithea	16	11	27
Pasiphae	20	19	39
Sinope	15	21	36
Phoebe ^a	32	98	130
Nereid ^a	11 ^b	1	12
Triton ^a	–	1	1

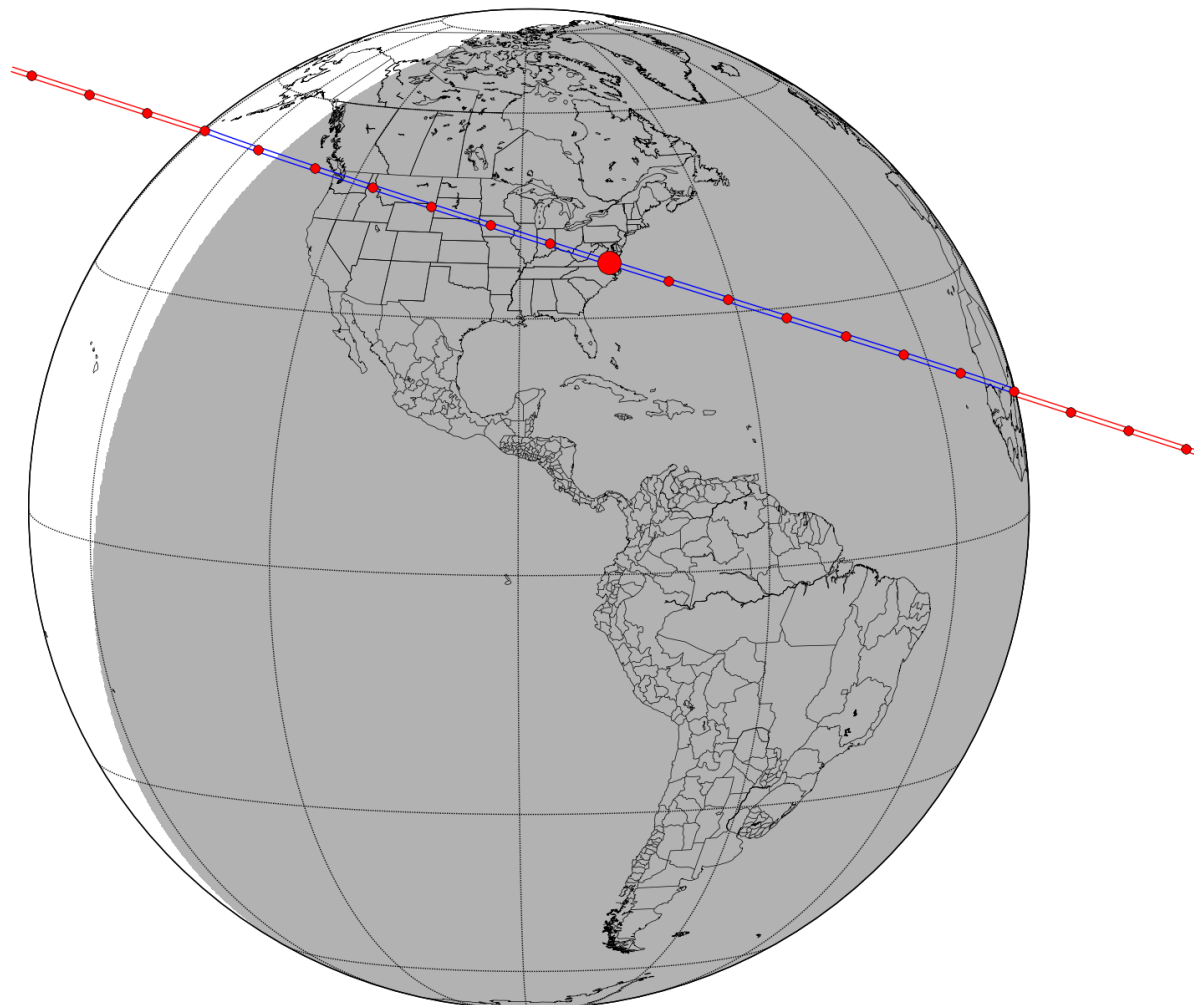
Occultations predicted using the UCAC4 catalogue and STE ephemeris. ^(a) Using JPL ephemeris. ^(b) Using the WFI catalogue as explained in Sec. [3](#).

Occultation Test



Pasiphae

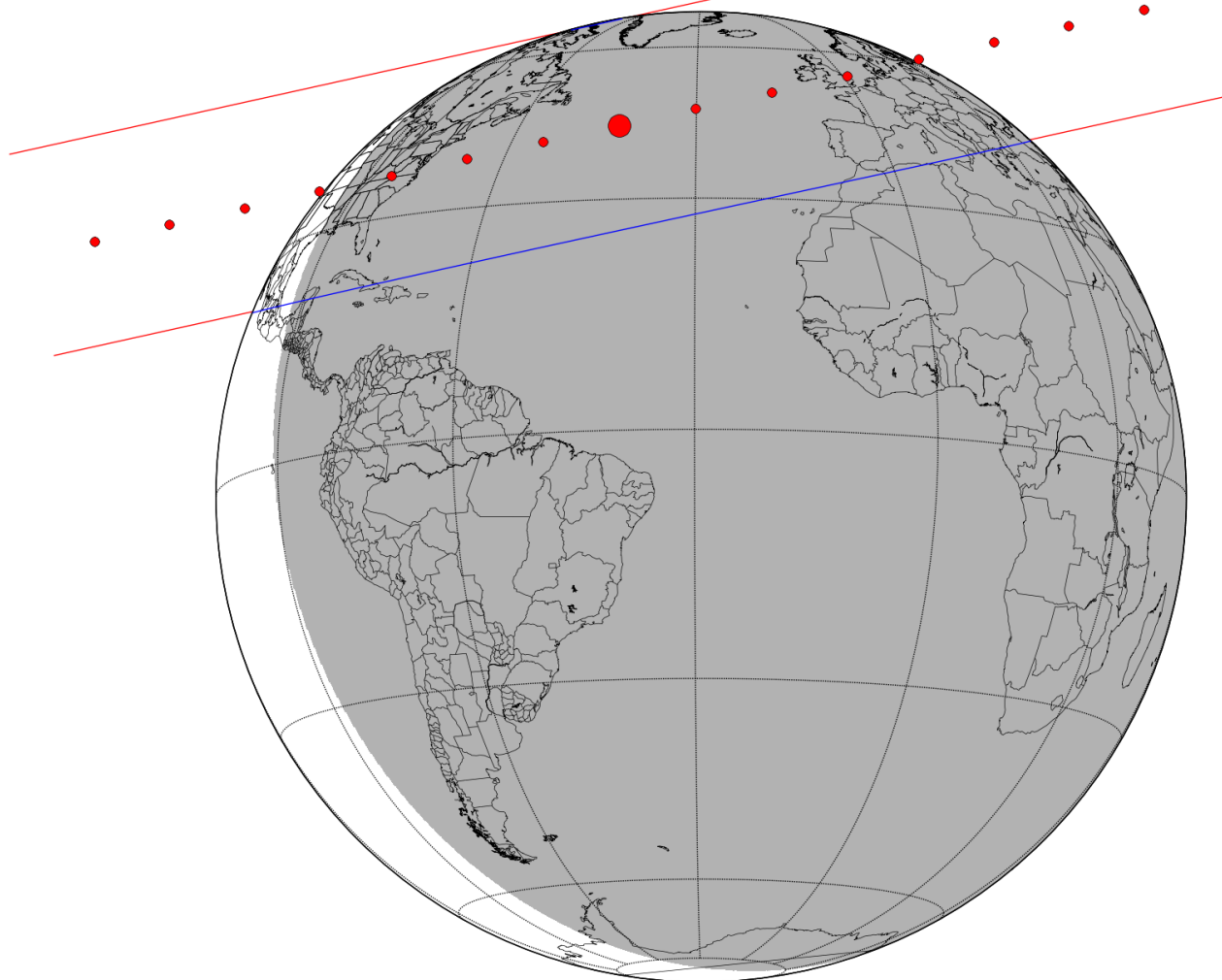
Object	Diam	Tmax	dots <>	ra_off_obj_de	ra_of_star_de
Pasiphae	60 km	4.7s	60 s <>	+0.0	+0.0



year-m-d	h:m:s UT	ra_dec_J2000_candidate	C/A	P/A	vel	Delta	R*	K*	long
2016-04-09	03:58:19.000	11 14 36.7707 +07 39 20.761	1.003	17.93	-12.88	4.54	14.9	-0.5	271

Triton

Object	Diam	Tmax	dots <>	ra_off_obj_de	ra_of_star_de
Triton	2707 km	161.2s	60 s <>	+0.0	+0.0



year-m-d	h:m:s UT	ra_dec_J2000_candidate	C/A	P/A	vel	Delta	R*	K*	long
2017-10-05	23:51:48.000	22 54 18.4370 -08 00 08.339	0.237	347.53	-16.79	29.08	12.3	-0.2	331



Obrigado