Astrometric Positions of Irregular Satellites of Giant Planets from 23 Years of Observations

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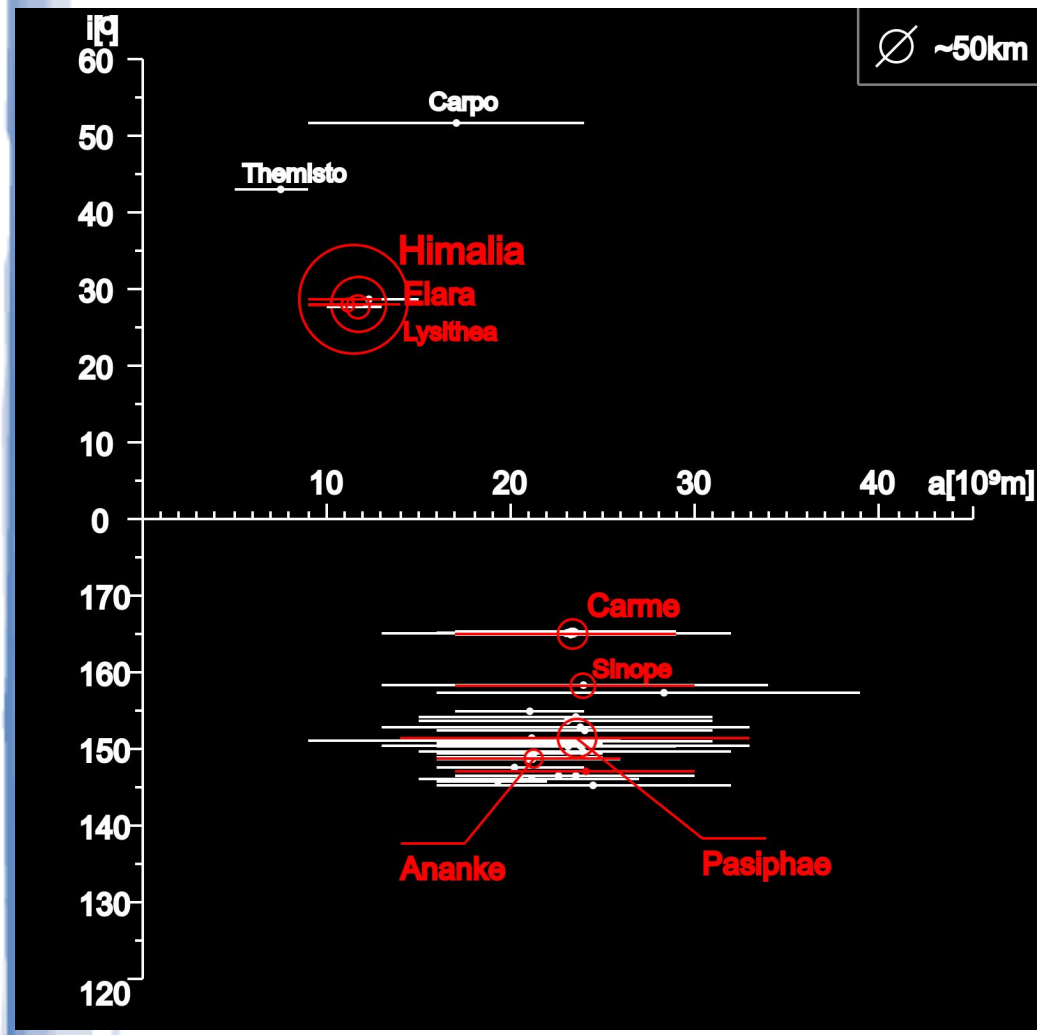
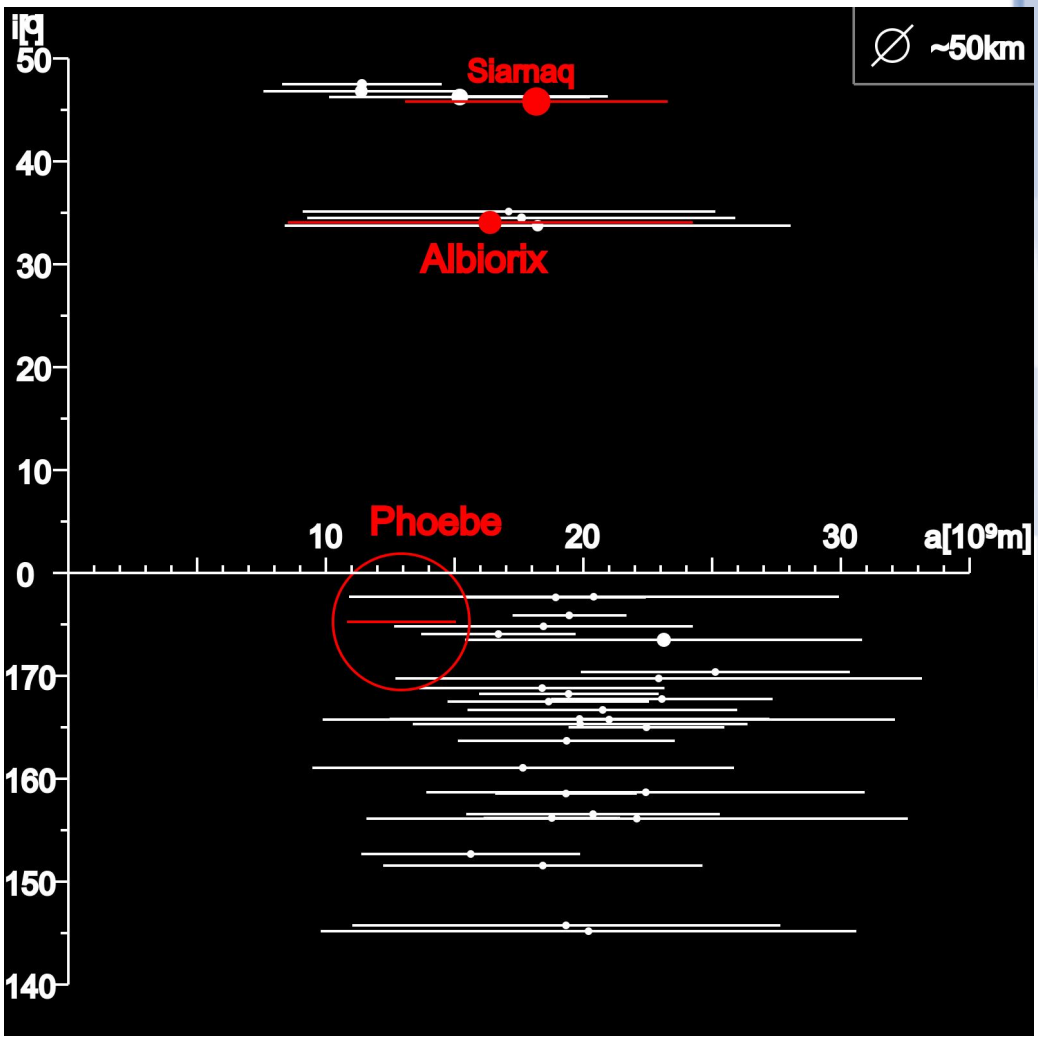
Goal

- Organize e reduce three database with images of the irregular satellites of the giant planets observed between 1992 e 2014 at OPD, OHP e ESO.
- Obtain precise positions from these observations which can be used to:
  - New numerical integrations of the orbits of these satellites.
  - Predict and observe stellar occultations by these objects.

Irregular Satellites



Satellites of Jupiter



Satellites of Saturn

Irregular Satellites

- Capture:
  - Gas Drag (Cuk & Burns, 2003);
  - 3-body interation (Nesvorný et al., 2007);
  - Collision (Sheppard, 2006).
- Orbital Evolution:
  - Origin of the orbital family of satellites (Nesvorný et al., 2004);

Observations

Telescope	Diameter	Number of CCDs	Filters	Number of Images	Time Span
OHP	1.2 m	1	Clear	24000	1998-2008
ESO	2.2 m	1	I	1500	2007-2009
OPD (PE)	1.6 m	9	Clear, U, B, V, R, I, Methane	42000	1992-2014
OPD (B&C)	0.6 m	11	Clear, U, B, V, R, I, Methane	72000	1995-2014
OPD (Zeiss)	0.6 m	9	Clear, B, V, R, I, Methane	20000	1996-2014

Reduction Process

- Bias and flat-field calibration.
- PRAIA:
  - Extract data of the header of the images;
  - Detect objects in the image (x, y);
  - Identify catalogue reference stars;
    - UCAC4
  - Obtain (α,δ) from gnomonic projection;
  - Identify targets in the images.
    - JPL ephemeris.

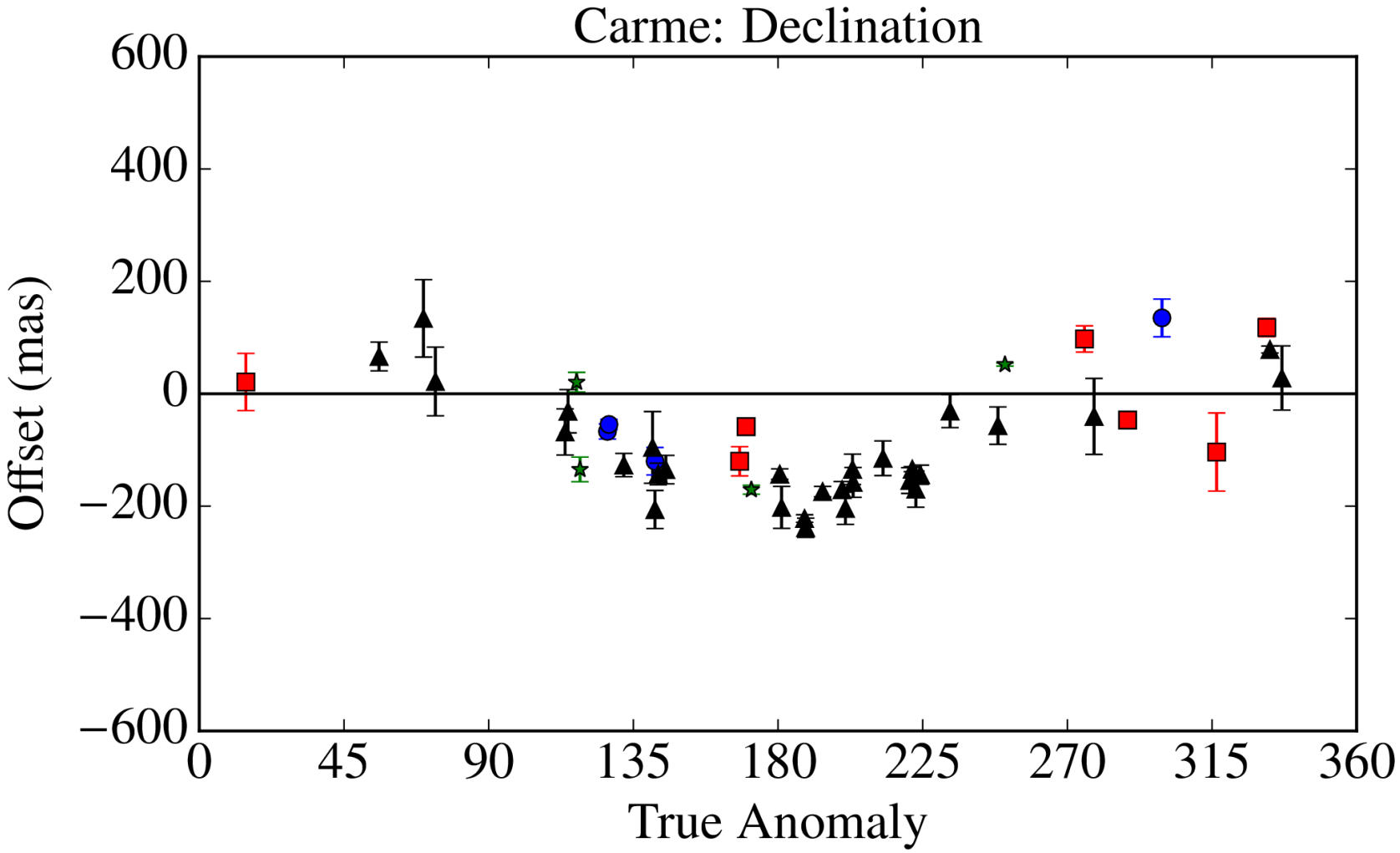
RESULTS

Results

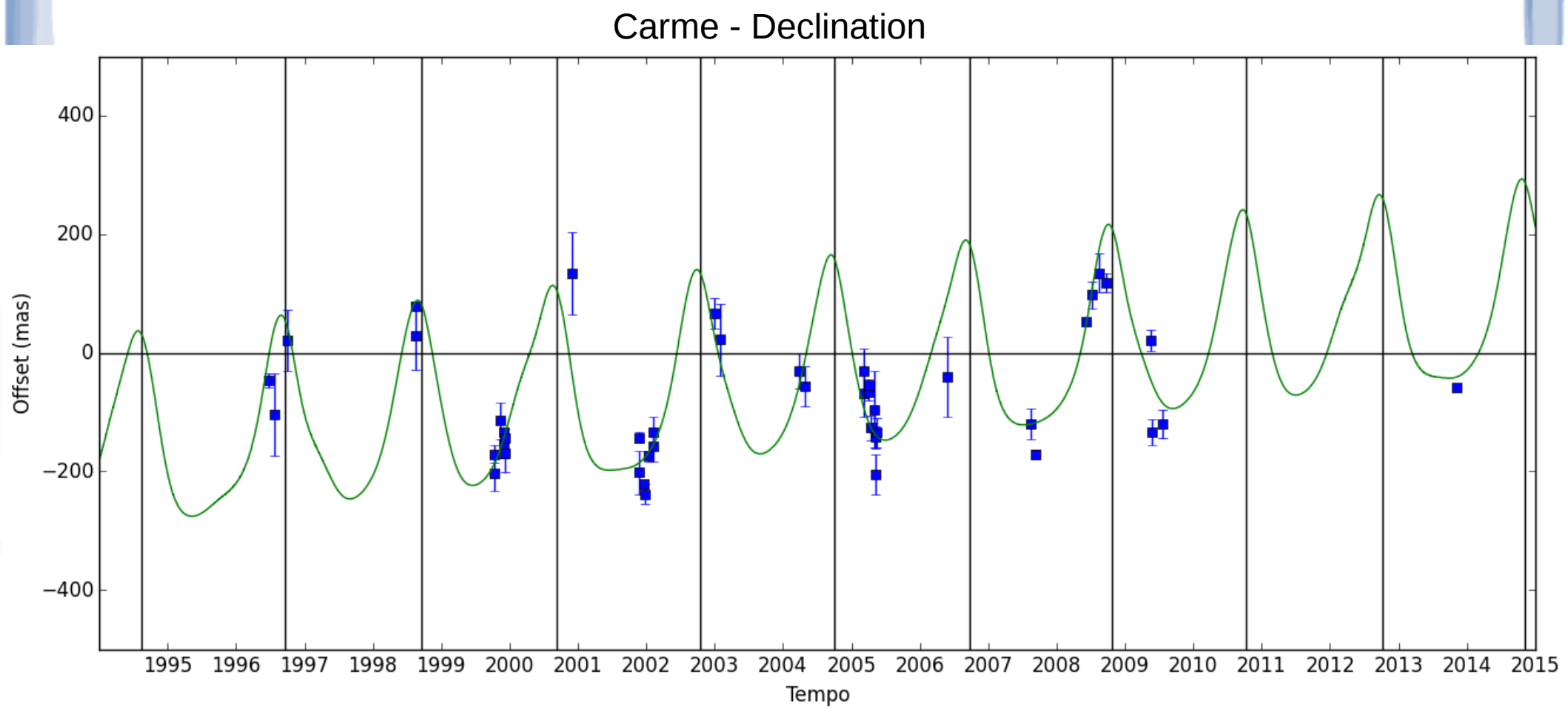
Satélite	Diâm. (km)[3]	Mag V	OPD	OHP	ESO	Total	Jacobson*
Himalia	170	14	854	357	23	1234	1757
Elara	86	16	403	187	46	636	1115
Lysithea	36	18	60	84	90	234	431
Leda	20	19	6	48	44	98	178
Pasiphae	60	17	295	248	66	609	1629
Callirrhoe	9	21	9	-	16	25	95
Megaclite	5	22	-	-	10	10	50
Ananke	28	18	52	141	57	250	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

* Jacobson, R. A. et al, 2012, The Astronomical Journal

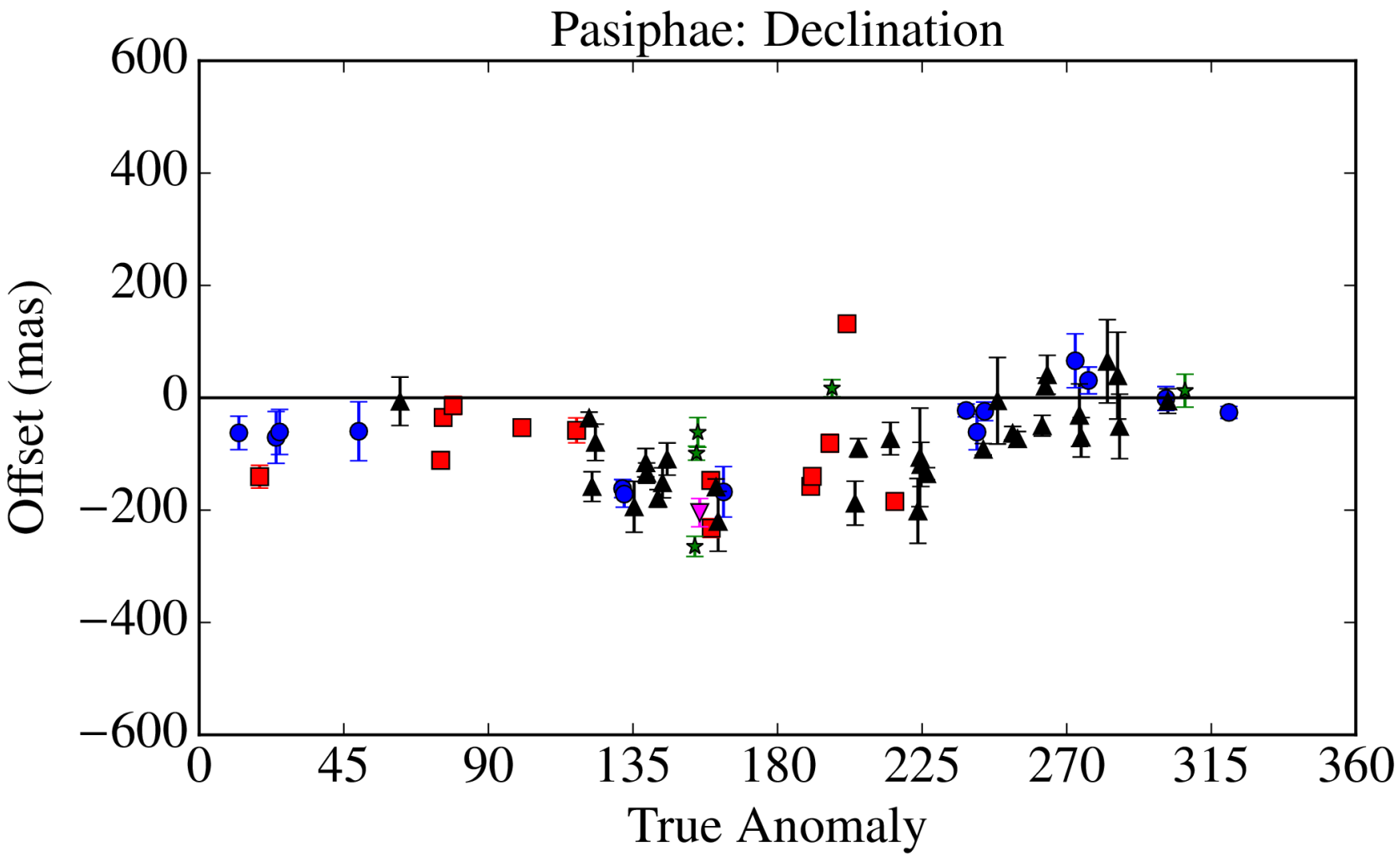
Results - Carme



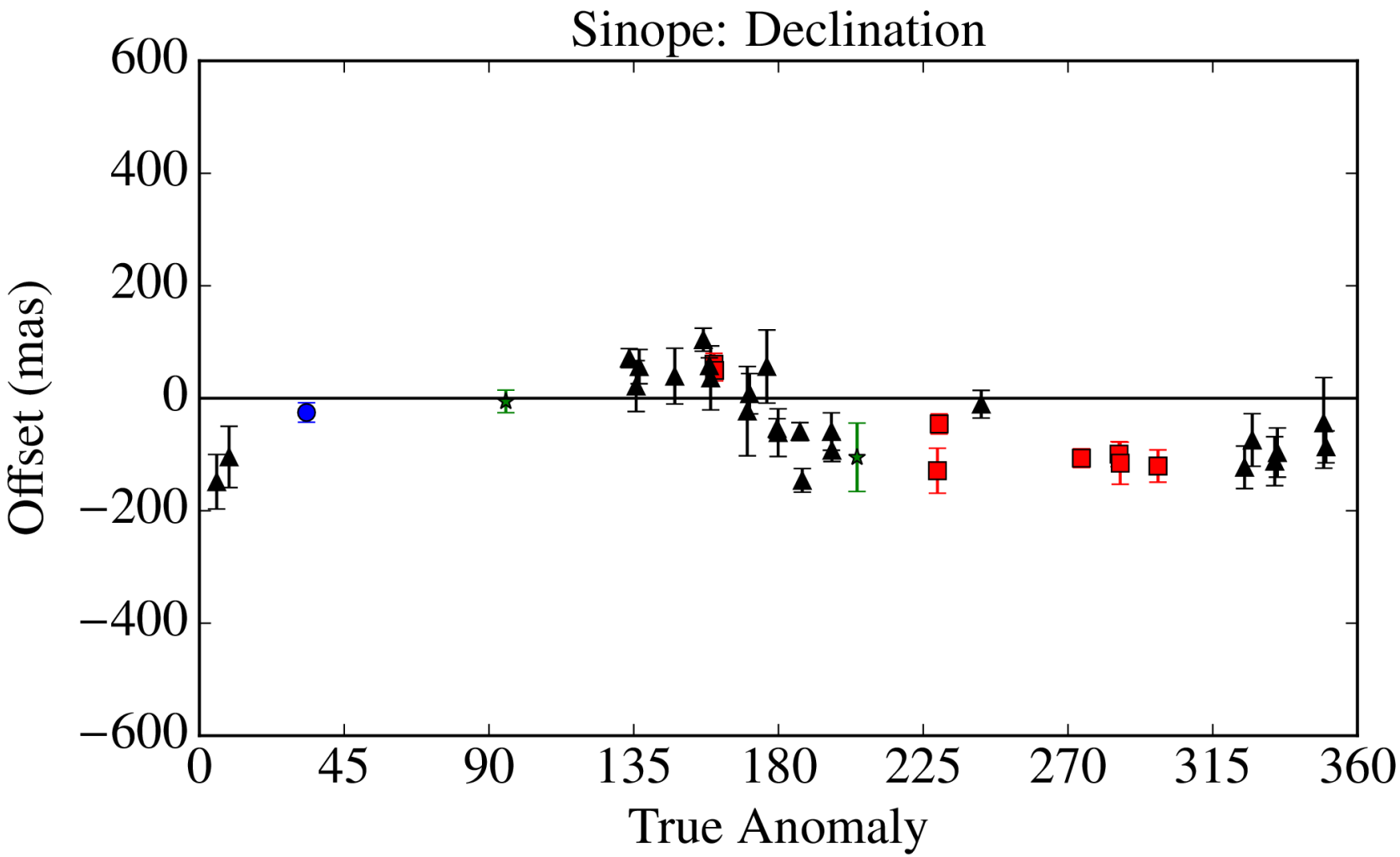
Results - Carme



Results - Pasiphae



Results -Sinope



Results

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Astronomy & Astrophysics

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

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Conclusion

- We identified 8466 observations of irregular satellites, from which we obtained 6523 suitable astrometric positions.
- Position errors estimated of about 60-80 mas depending on brightness.
- All positions are available at the CDS

Next Steps

- Numerical Integration of the orbits of the Irregular Satellites.
- Predict and observe stellar occultations by these objects.
- Re-reduce the observations with GAIA catalogue.

Thank You