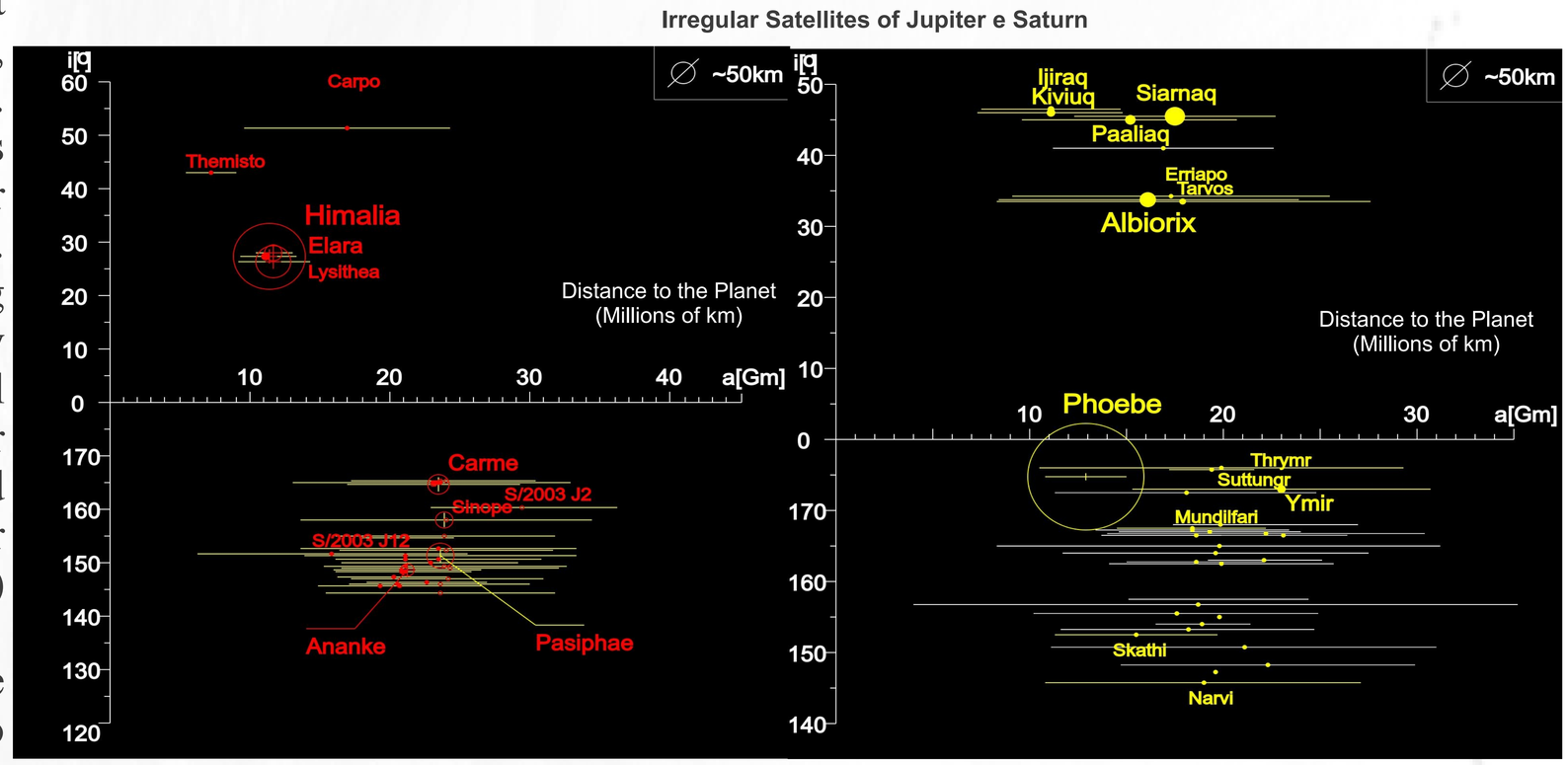
Astrometric positions for the irregular satellites of Jupiter and Saturn

Altair Ramos Gomes Júnior[1], Marcelo Assafin[1], Roberto Vieira Martins[2], Júlio I. B. Camargo[2], Alexandre H. Andrei[2], Dario Nepomuceno da Silva Neto[3], Gustavo B. Rossi[2], Alex Dias Oliveira[2], Felipe Braga-Ribas[2]
1-OV/UFRJ; 2-ON/MCT; 3-UEZO

The irregular satellites of the giant planets, mainly from Jupiter and Saturn, are much smaller than the regular ones. They have irregular shapes and their orbits are more eccentric with larger semi-major axes. Some of them have retrograde orbits. Explaining their existence is an interesting study in orbital dynamics. It's generally accepted that, due to their orbital configuration, they were captured by their planets. Stellar occultations are a method that would allow us to know better their physical features (size, shape, density) since they are not visited, at the moment, by any spacecraft. But their orbits are known with little precision, which is bad to obtain a good prediction for a occultation.



In this work, we aimed at organizing and reducing CCD images of the Jovian and Saturnian Irregular Satellites observed at the Observatório do Pico dos Dias (1,60 and 0,6m telescopes) and at the Observatoire Haute-Provence (1,2m telescope). The observational data from these two observatories comprise more than 100.000 images. The reduction of this considerable amount of images with the necessary accuracy in position was only possible with the use of PRAIA. First, we eliminate discrepant positions night by night using a sigma-clip procedure. Then, we analyze the differences between the observed and ephemeris positions of the satellites to better constrain the origin of systematic differences and properly provide corrections to the orbits of the satellites. The projection of the orbits on the sky, along with vectors representing systematic effects on positions (see graphic below), clearly shows how this work contribute to a better determination of the orbits of the satellites .

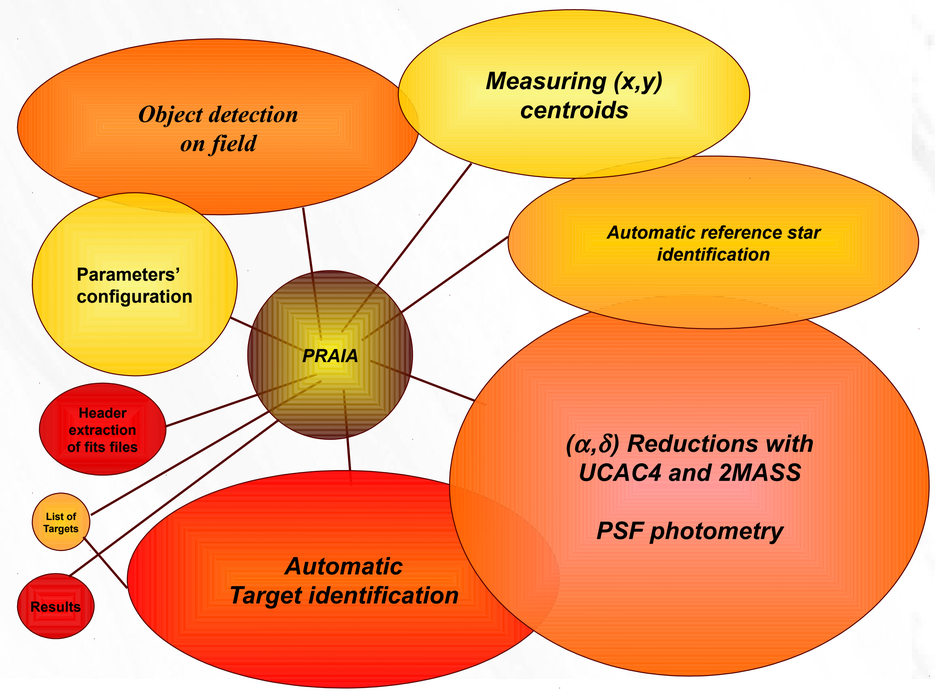
Database: comparison between LNA and OHP

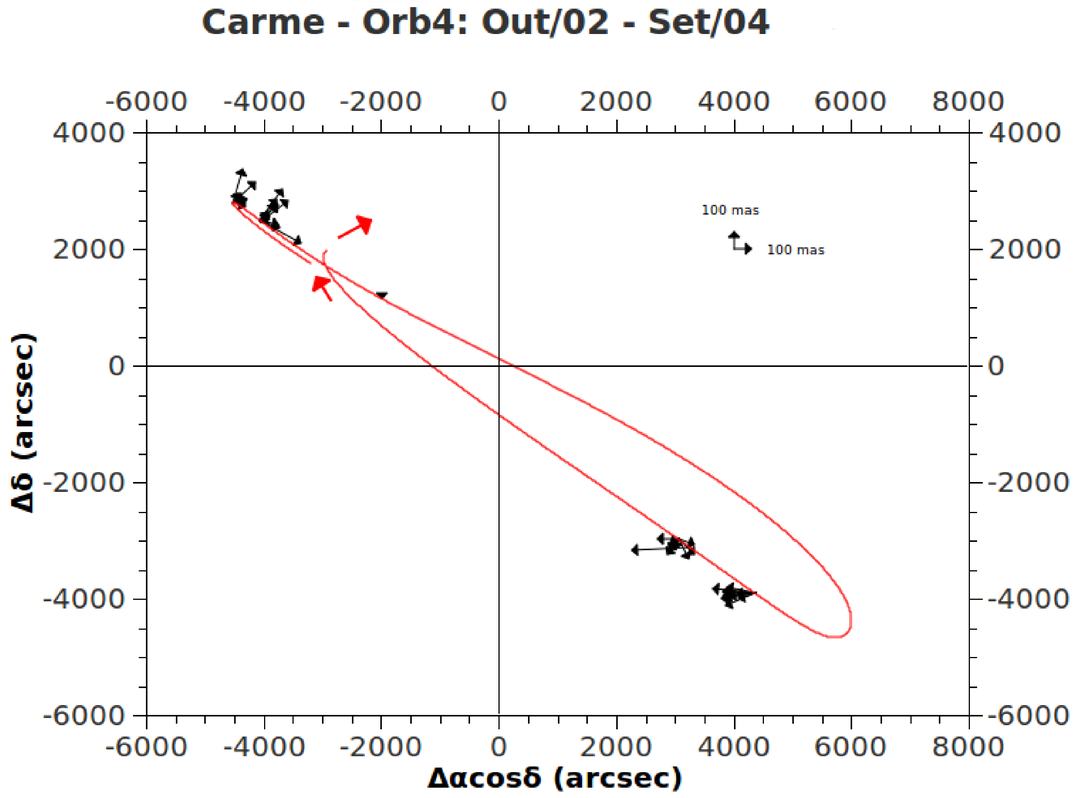
	OHP		LNA		
Telescope	1.2m	1.6m	IAG (0,6m)	Zeiss (0,6m)	Total
Images	27.963	30.380	50.240	7.979	88.599
Nights	354	196	254	30	480
Filters	Clear	Clear, Methane, B, V, R, I			
Period	1997 - 2008	1992-2012			

Statistics by satellite/observatory

	OHP					160					IAG				
	NI	o RA	σ RA	o DE	σ DE	NI	o RA	σ RA	o DE	σ DE	NI	o RA	σ RA	o DE	σ DE
Ananke	156	29	99	-8	76	71	39	201	-67	182					
Carme	222	-2	88	-52	85	35	11	149	-33	102	23	56	96	3	67
Elara	203	-9	71	-26	75	101	-67	180	-39	122	290	35	118	-61	77
Himalia	401	-4	61	5	71	213	-30	232	-22	97	542	0	115	-3	146
Leda	54	3	129	152	83	12	289	291	51	91					
Lysithea	91	6	67	-46	61	65	49	108	-55	105	7	-30	121	23	53
Pasiphae	258	-49	86	-63	88	59	40	195	-76	107	172	-62	112	-32	80
Sinope	189	-67	199	-21	92	47	204	207	-81	132	7	285	146	-43	68
Phoebe	590	-4	44	5	44	61	-12	66	-48	46	540	6	92	-45	78

Mean and standard deviation of the offsets in Right Ascension and Declination; NI: Number of Images





Agradecimentos

Observatório do Valongo
Observatório Nacional
CNPq
FAPERJ
Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro