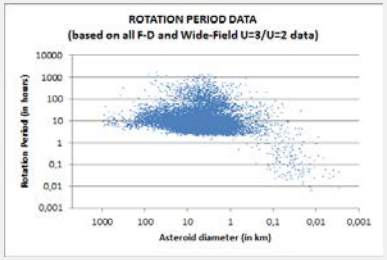
CERTAINTIES, QUESTION MARKS AND VOIDS IN THE PRESENT-DAY DATA CONCERNING THE ROTATION PERIOD OF ASTEROIDS

Eduardo Manuel Álvarez[1,2]

[1]Universidad de la República, Centro Universitario Sede Salto [2]Observatorio Los Algarrobos, Salto, Uruguay

Studies of asteroid rotation rates and lightcurve properties provide important data for development of theories of asteroid structure and physical processes. There are more than 680,000 asteroids with well-defined orbits. However, the LCDB data base (version feb 2017) contains rotation period data for only 17,437 asteroids and yet, more than two thirds of those reported measurements still may be uncertain by 30% (U=2) and another 10% may be completely wrong (U=1).

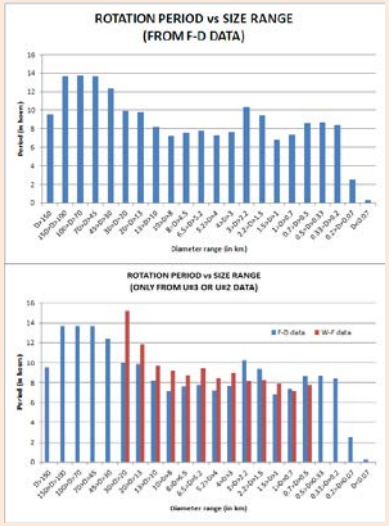


It should be possible to know the characteristics of asteroid spins without measuring every last one of them, on condition that our sample (1) is unbiased, and (2) it properly includes odd or outlier objects.

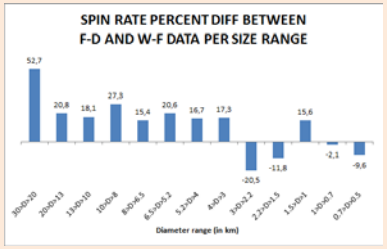
U=2 data should be good enough for both statistical analysis and for identifying oddballs.

Range of Asteroid Diameter (km)	F-D data			W-F data (only U = 3 and U = 2)		
	quantity	Mean log	Mlog P (h)	quantity	Mean log	Mlog P (h)
D > 150	137	0.980	9.55	2		
150 > D > 100	163	1.137	13.71	0		
100 > D > 70	242	1.138	13.73	1		
70 > D > 45	367	1.136	13.67	5		
45 > D > 30	451	1.092	12.36	27		
30 > D > 20	495	0.998	9.96	118	1.182	15.21
20 > D > 13	476	0.992	9.82	310	1.074	11.86
13 > D > 10	381	0.913	8.19	427	0.985	9.67
10 > D > 8	354	0.858	7.21	532	0.963	9.18
8.0 > D > 6.5	443	0.881	7.60	667	0.943	8.76
6.5 > D > 5.2	396	0.893	7.82	804	0.974	9.42
5.2 > D > 4.0	434	0.860	7.25	1192	0.927	8.46
4.0 > D > 3.0	313	0.885	7.67	1350	0.954	9.00
3.0 > D > 2.2	305	1.012	10.29	1398	0.913	8.18
2.2 > D > 1.5	187	0.972	9.38	1371	0.918	8.27
1.5 > D > 1.0	161	0.836	6.85	1009	0.899	7.92
1.0 > D > 0.7	108	0.867	7.37	431	0.858	7.21
0.7 > D > 0.5	100	0.936	8.63	111	0.892	7.80
0.5 > D > 0.33	111	0.939	8.68	15		
0.33 > D > 0.2	110	0.923	8.37	5		
0.2 > D > 0.07	119	0.407	2.55	12		
D < 0.07	125	-0.601	0.25	0		

Since 2012, wide-field asteroid photometric surveys have been revolutionizing the incoming flow of new data to the LCDB, now comprising the majority (~60%) of data we have. However, due to the overwhelming volume of W-F data, their corresponding reliability is in practice almost impossible to assess on a case-by-case basis. This poses the question whether including W-F data actually improves or degrades statistical analysis performed using only well controlled, reliable data (F-D file).

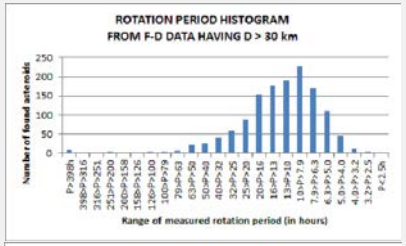


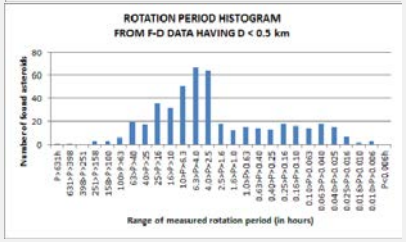
The answer: for size ranges where both F-D and W-F data samples contains at least 100 values, the W-F mean significantly differs from the F-D value.



W-F data inevitable biases due to the low success rate such surveys yield (somewhere in the range of 10-30% of targets analyzed).

With respect to studies of extremes of rotation, W-F surveys and less controlled samples can be useful, if the limitations are reasonably characterized.





Conclusions

By comparing the spin statistics of W-F results against the reliable non-W-F results in each size range, it comes evident that the vast new sample from W-F surveys does degrade the results from the smaller but more carefully controlled F-D data set.

The degree of bias in the W-F data for asteroids having diameters between 3 to 20 km is consistently uniform.

Only for asteroids having 1 < D < 0.7 km the W-F data appears to be as almost unbiased.

Contact info:

Eduardo Manuel Álvarez

olasu@adinet.com.uy