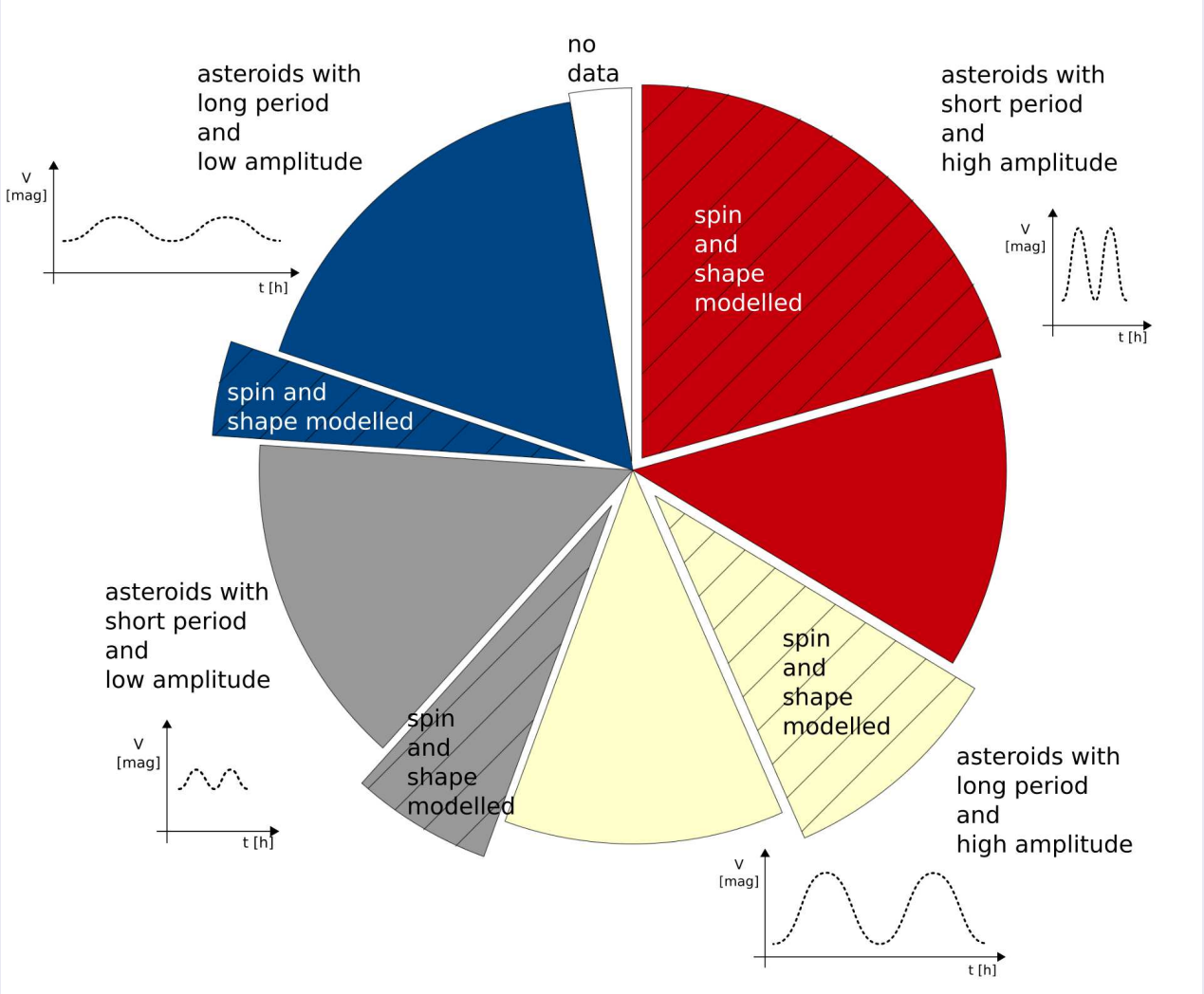
Filling the gap
Asteroids with slow rotation in thermal infrared

A. Marciniak[1], V. Alí-Lagoa, T. Müller, P. Bartczak
R. Behrend, M. Butkiewicz-Bąk, G. Dudziński, R. Duffard, K. Dziadura,
S. Fauvaud, S. Geier, J. Grice, R. Hirsch, J. Horbowicz, K. Kamiński,
P. Kankiewicz, D.-H. Kim, M.-J. Kim, I. Konstanciak, V. Kudak, L. Molnár,
F. Monteiro, W. Ogłoza, D. Oszkiewicz, A. Pál, N. Parley, F. Pilcher, E. Podlewska - Gaca, T. Polakis, J. J. Sanabria, T. Santana-Ros, B. Skiff, K. Sobkowiak,
R. Szakáts, S. Urakawa, M. Żejmo, K. Żukowski

1. Astronomical Observatory Institute, Faculty of Physics, A. Mickiewicz University, Poznań, Poland.

Selection effects in MBA models



All 1230 asteroids with H$\geq$11 mag
Division values: P = 12 h, a_{max} = 0.25 mag.

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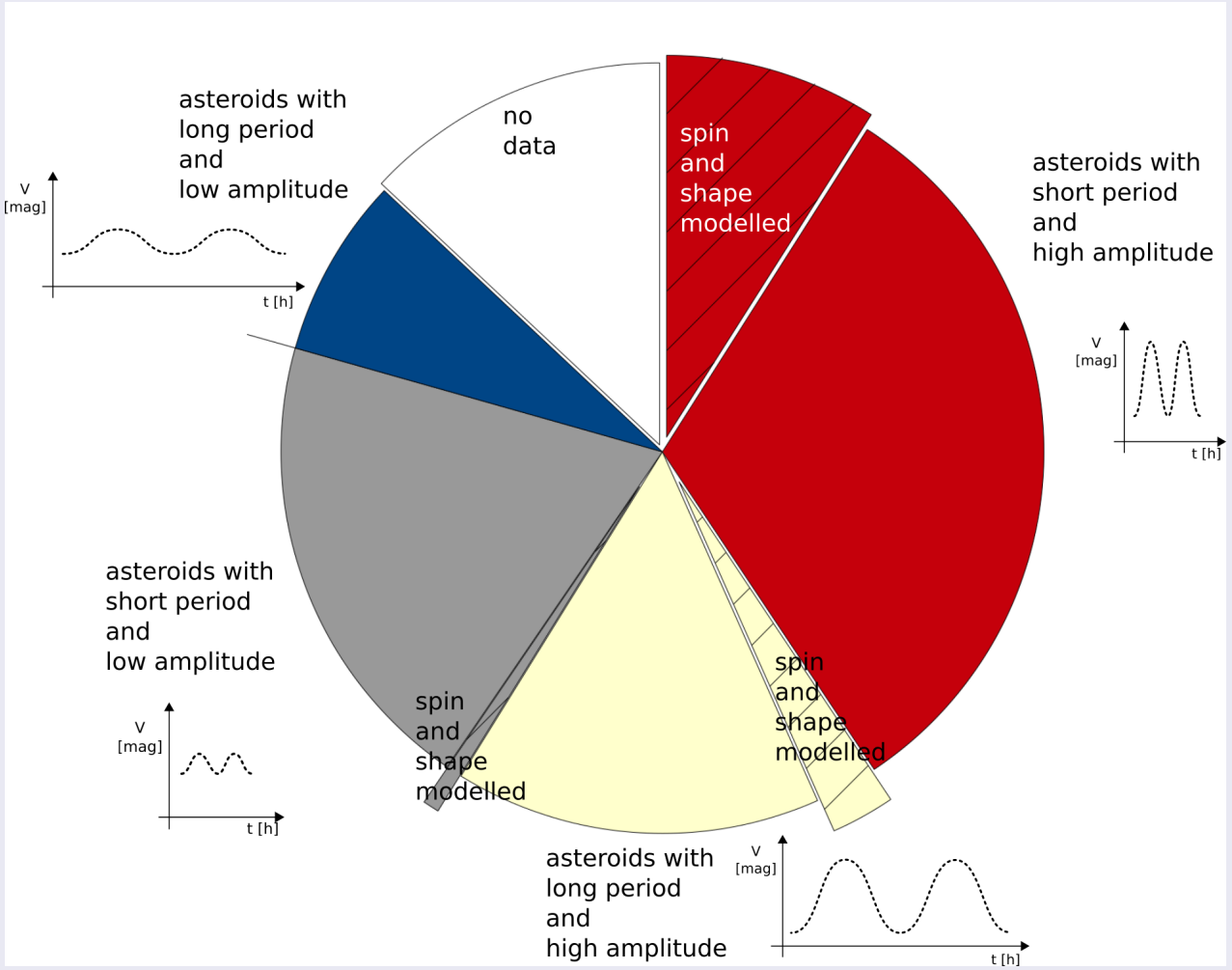
Selection effects in fainter MBA models



All 2274 asteroids with $11 < H \leq 13$ mag
Division values: P = 12 h, a_{max} = 0.25 mag.

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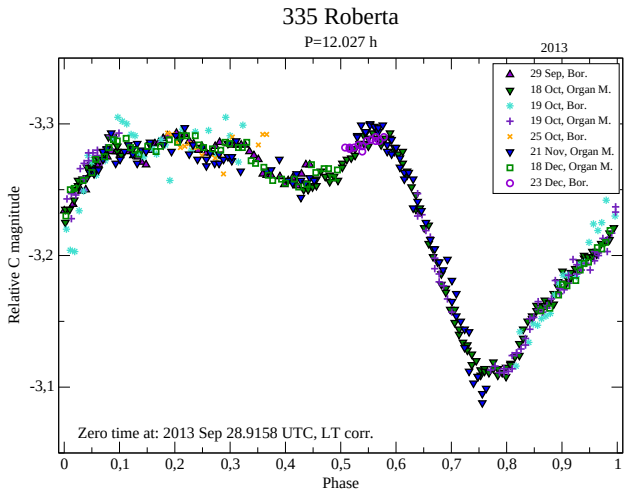
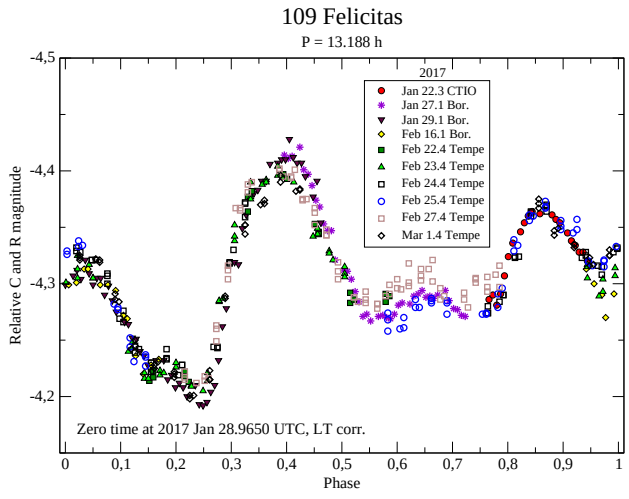
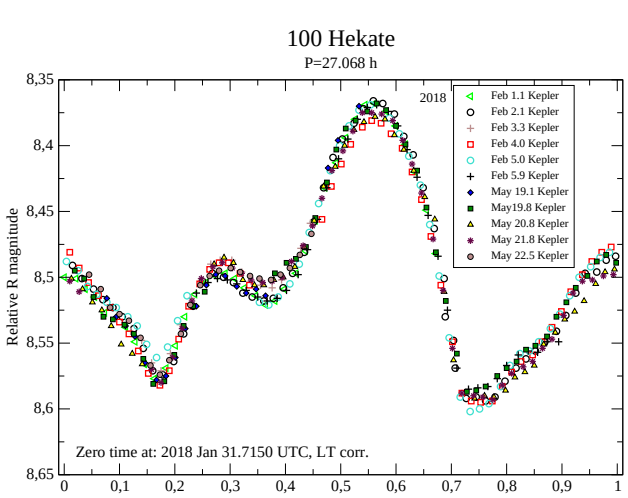
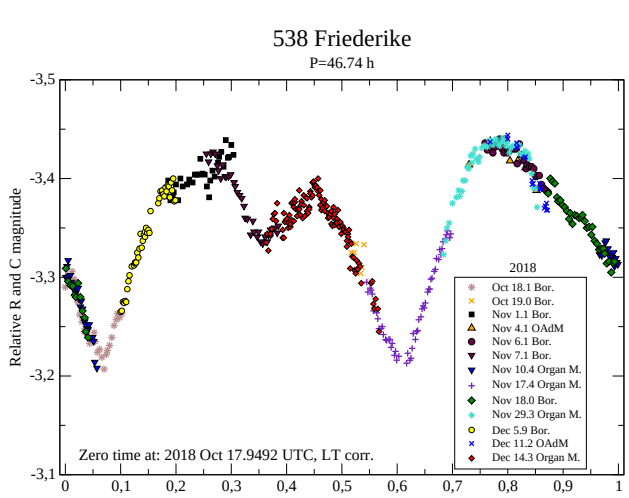
Selected lightcurves

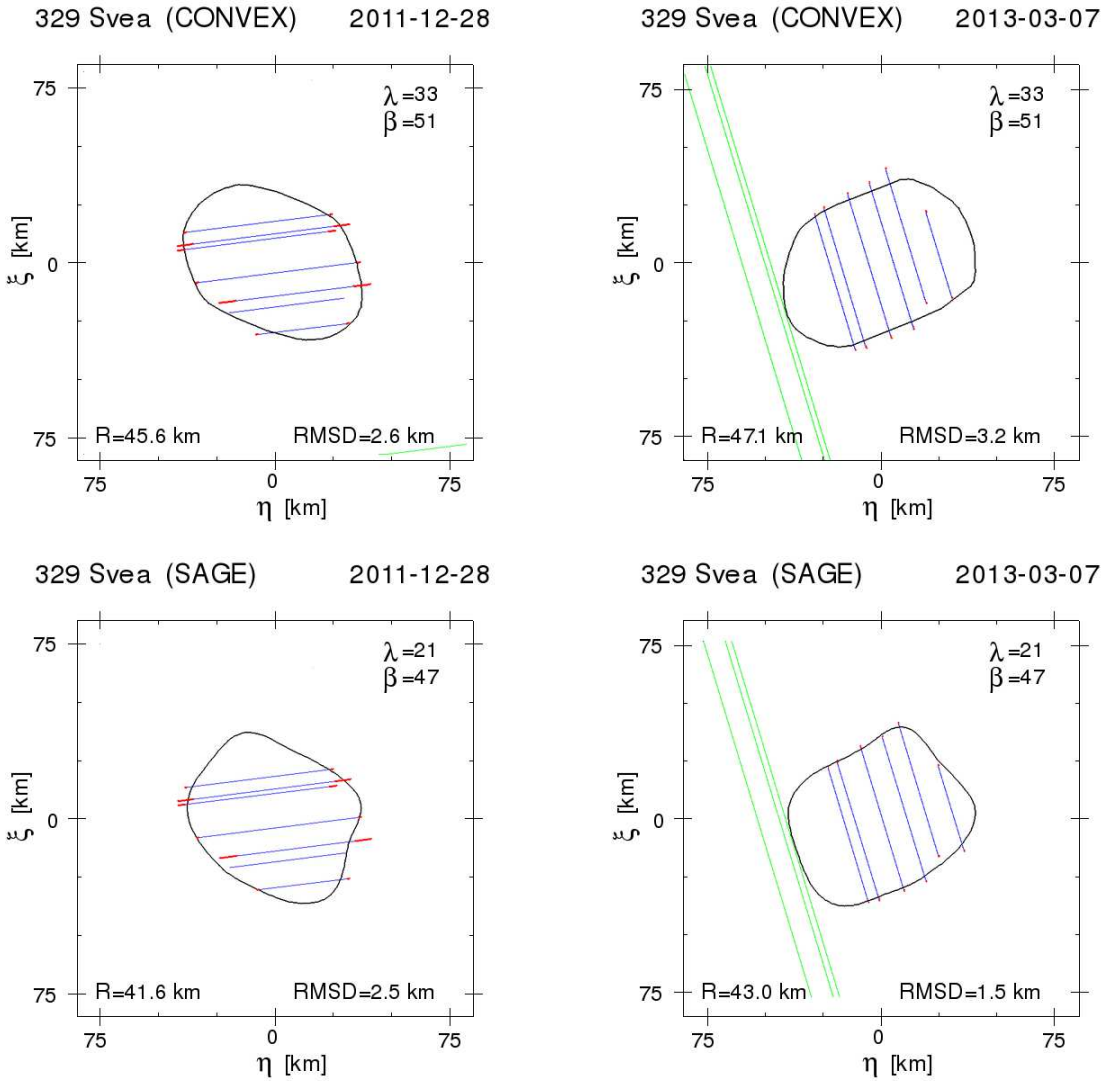








Fitting the shape models to stellar occultation chords



Diameters of equivalent volume sphere:
CONVEX (2011): 72 ± 4 km; CONVEX (2013): 74 ± 5 km
SAGE (2011): 70 ± 4 km; SAGE (2013): 72 ± 3 km

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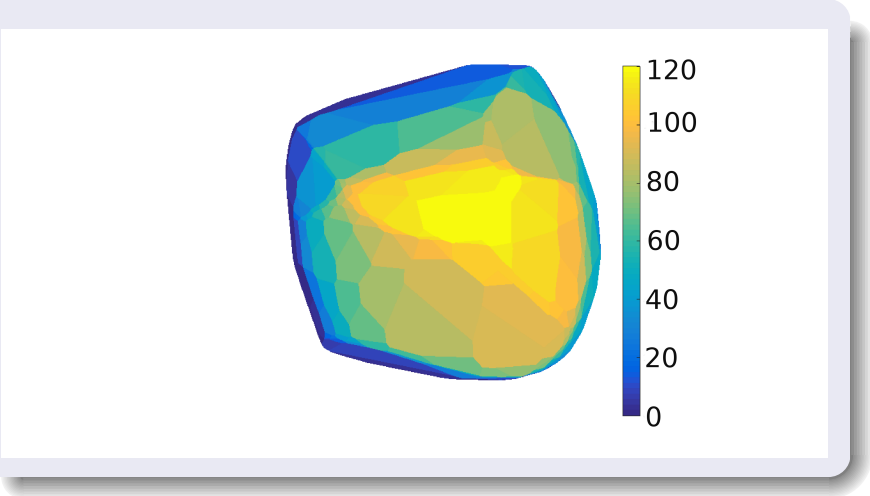
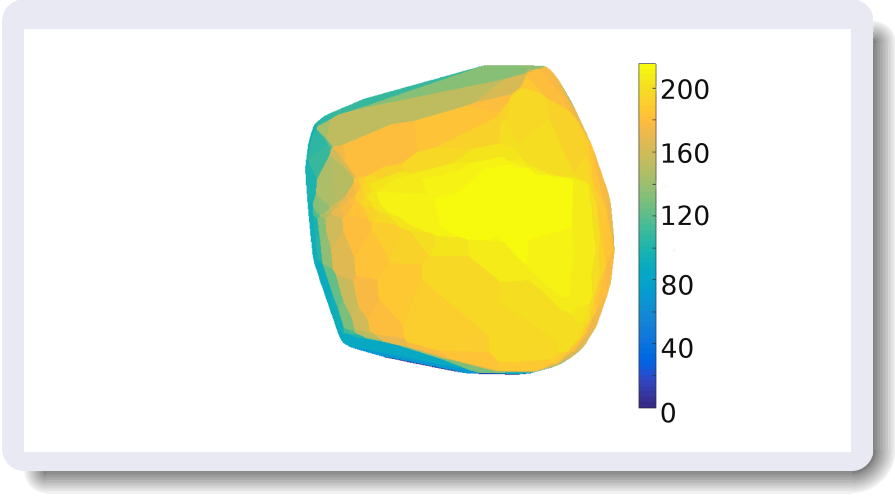
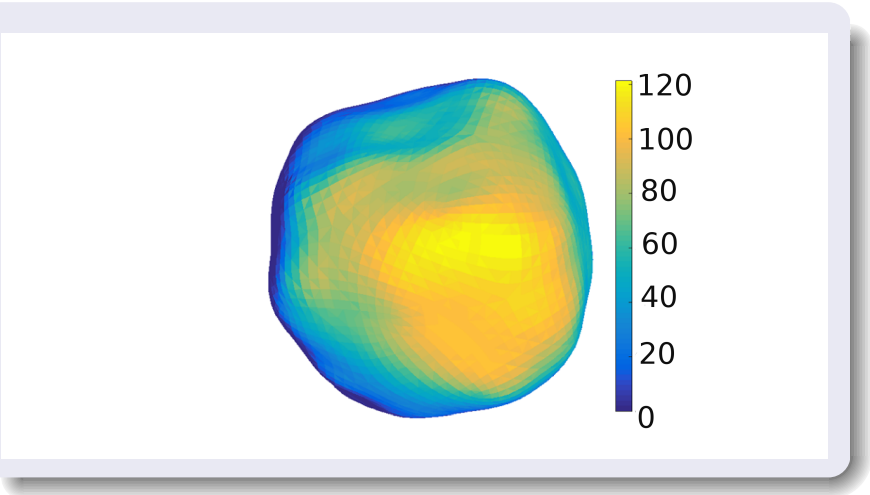
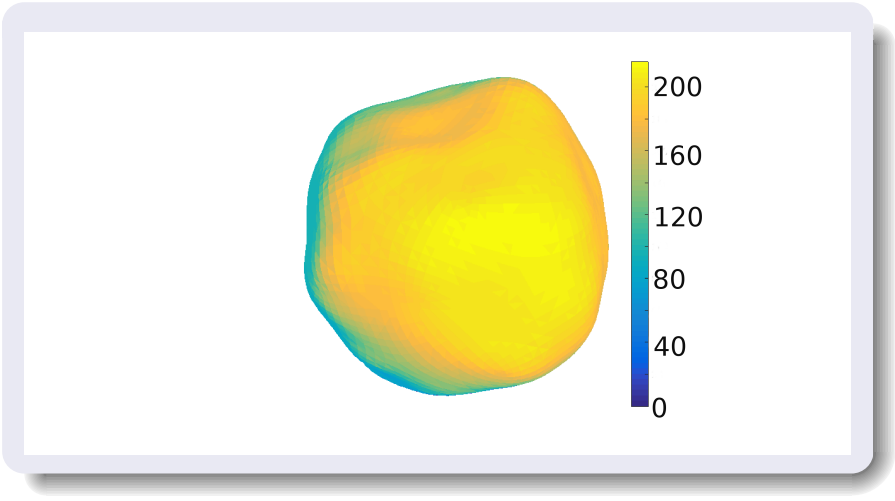
Thermophysical modelling

Insolation and surface temperature distribution: (159) Aemilia

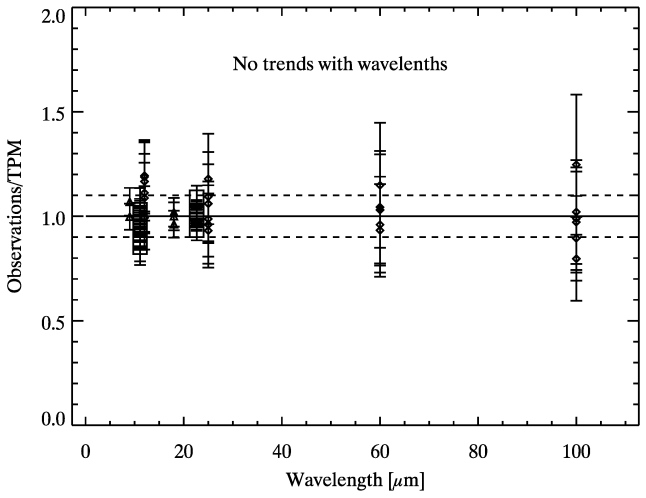


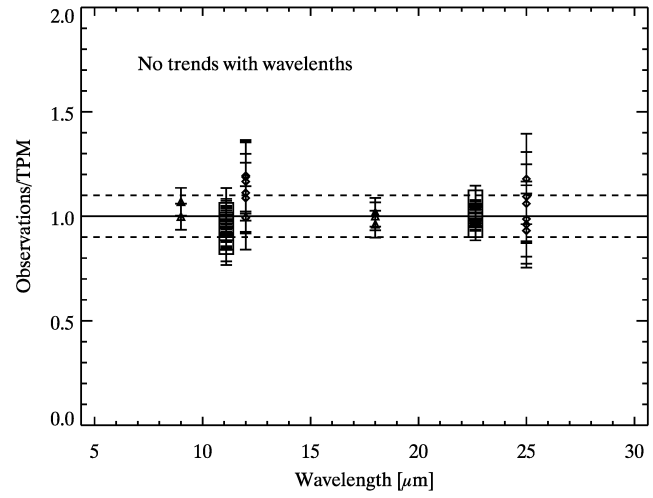


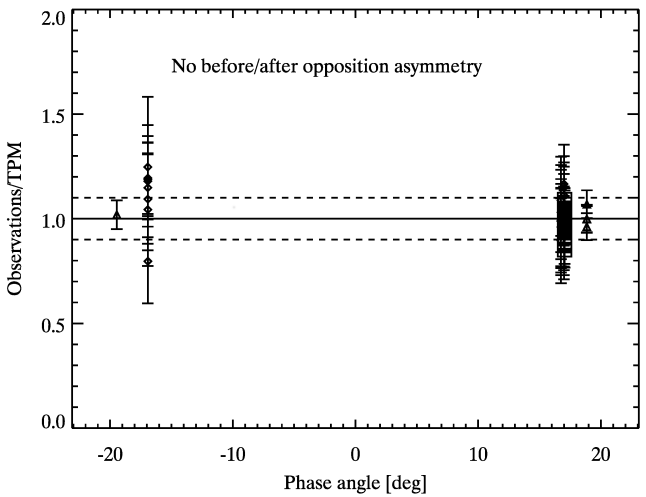


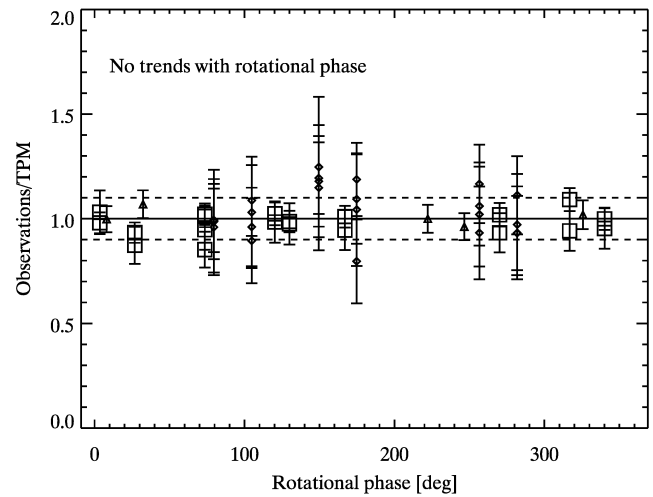


O-C plots for (159) Aemilia model applied in TPM









Target	Rotation period [h]	Taxonomic type	Radiometric solution for combined data. Diameter [km]	Albedo	Thermal inertia [$Jm^{-2}s^{-0.5}K^{-1}$]
159 Aemilia	24.4787 ±0.0001	Ch	137 ±8	0.054 ±0.015	50 ±50
227 Philosophia	26.4614 ±0.0001	C	101 ±5	0.041 ±0.005	125 ±90
329 Svea	22.7670 ±0.0001	C	78 ±4	0.055 ±0.015	75 ±50
478 Tergeste	16.10312 ±0.00003	L	87 ±6	0.15 ±0.02	75 ±45
487 Venetia	13.34133 ±0.00002	S	70 ±4	0.21 ±0.02	100 ±75

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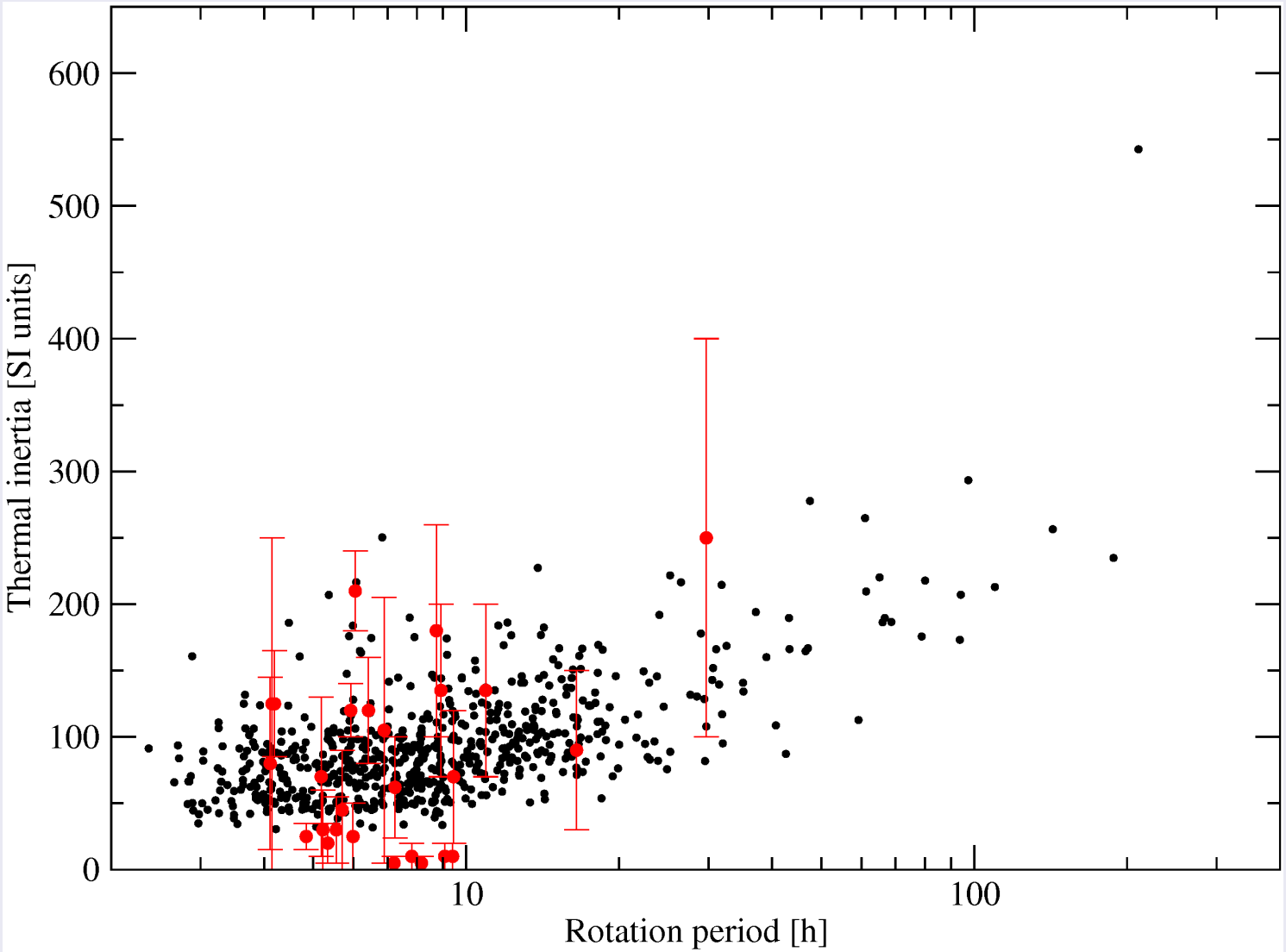
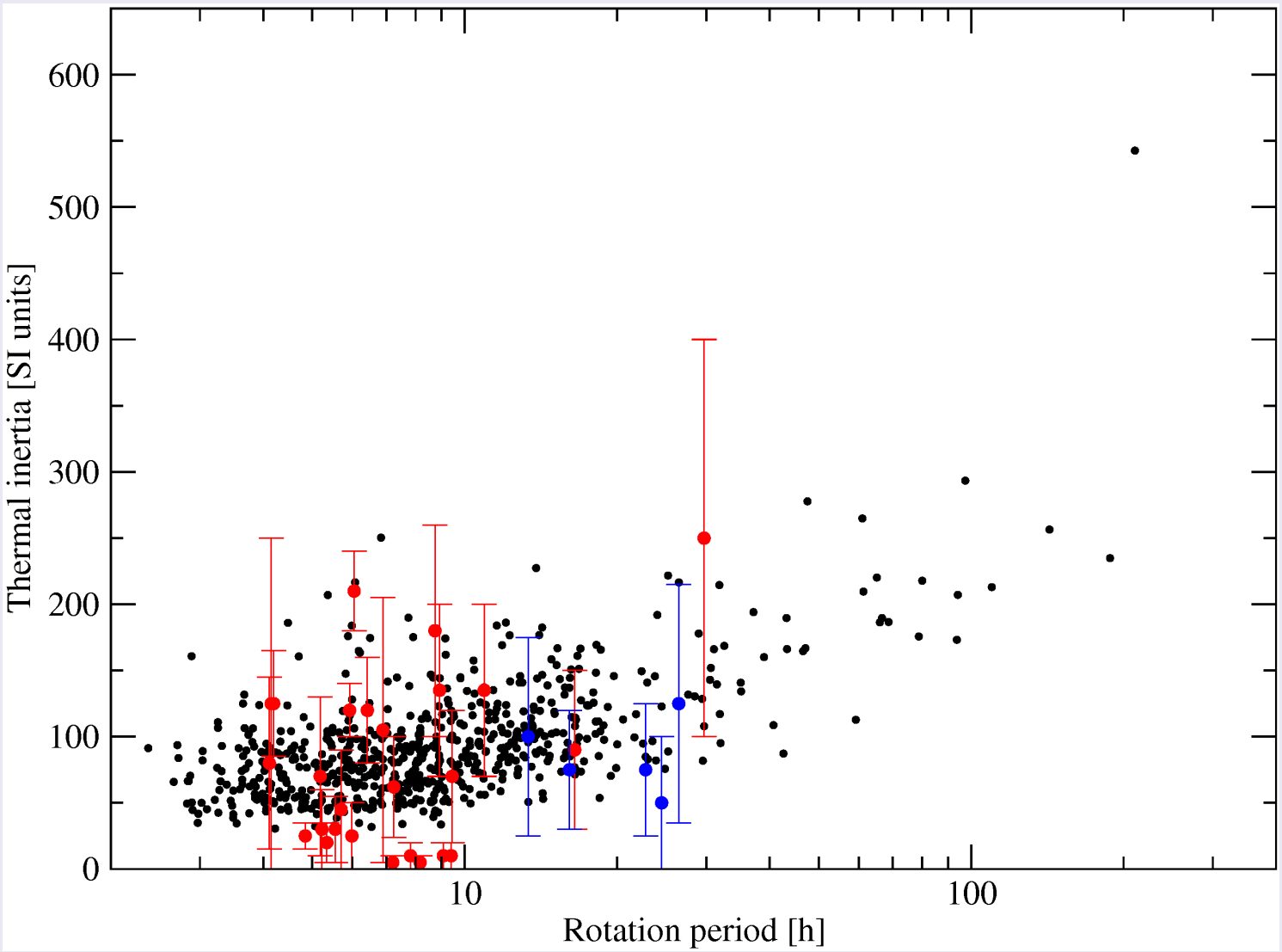
Thermal inertia of Main Belt Asteroids



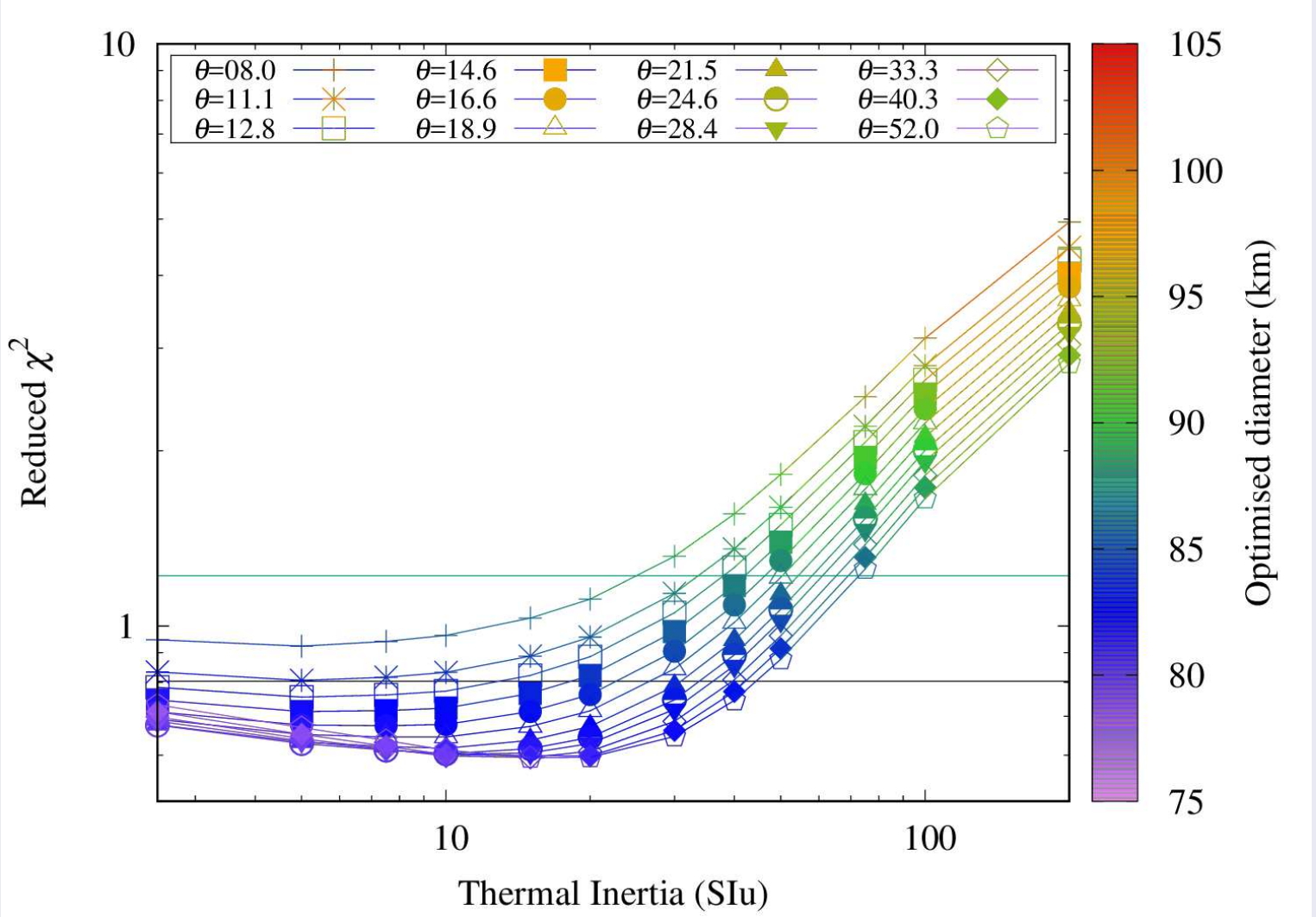
Harris & Drube 2016

Thermal inertia of slow rotators

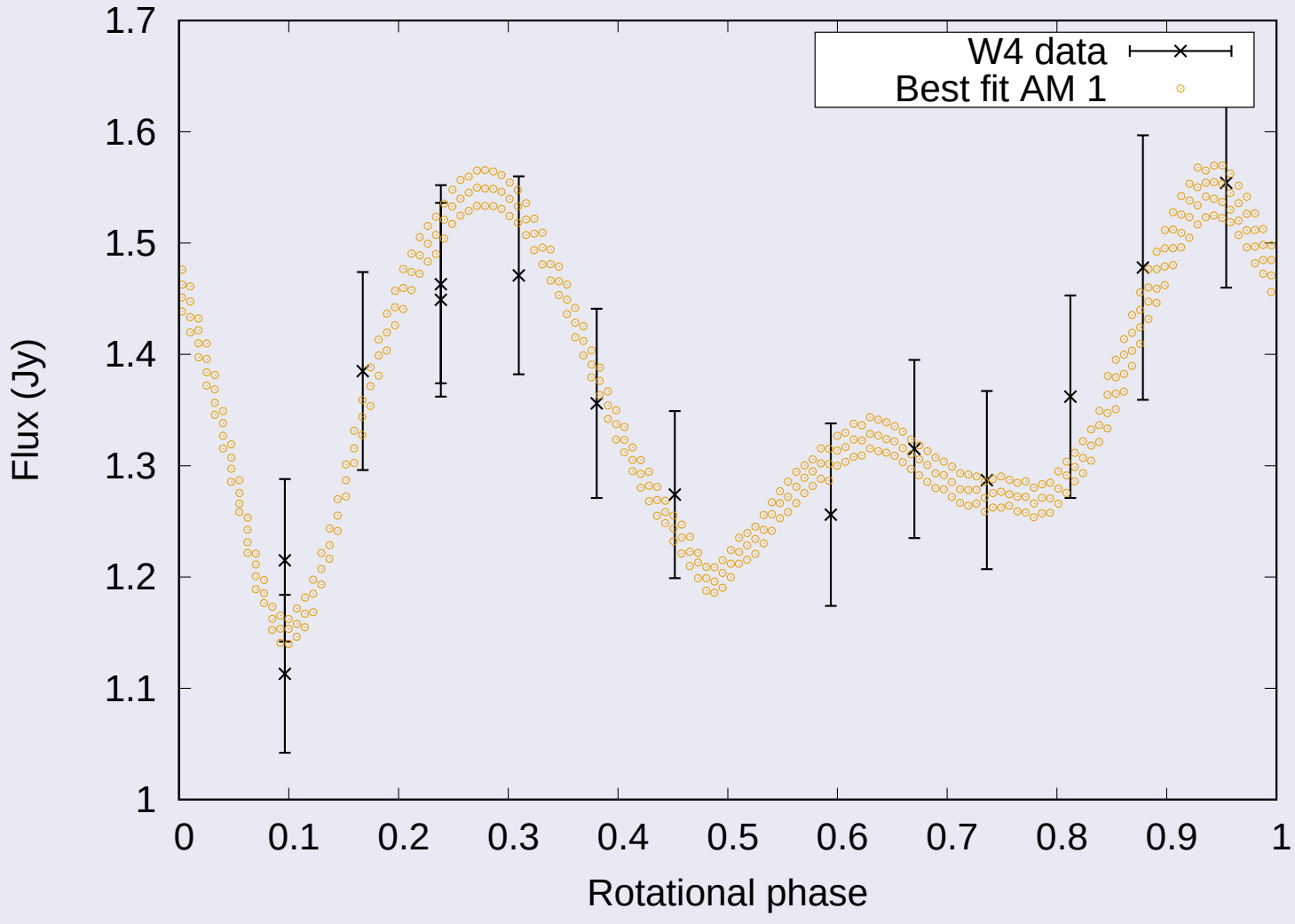


after: Harris & Drube 2016

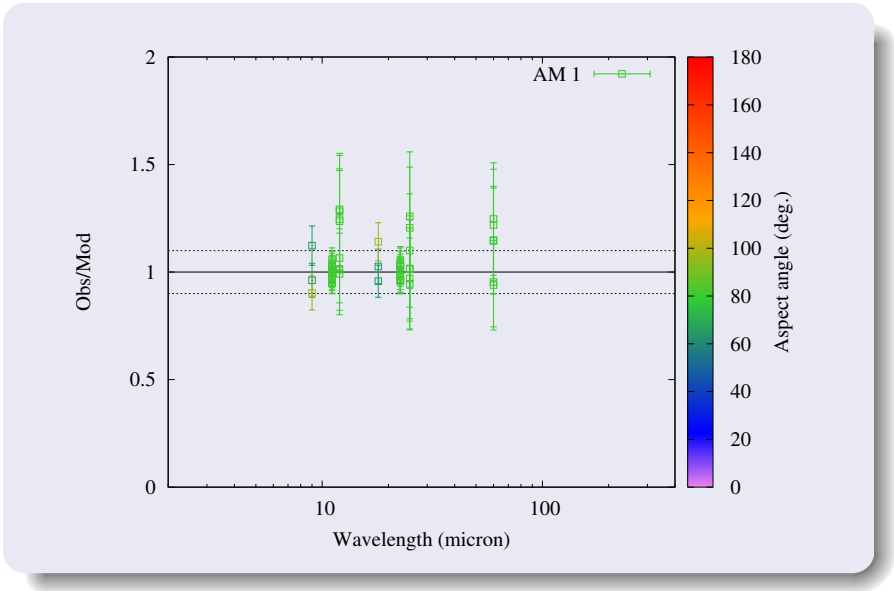
(195) Eurykleia model in thermophysical modelling

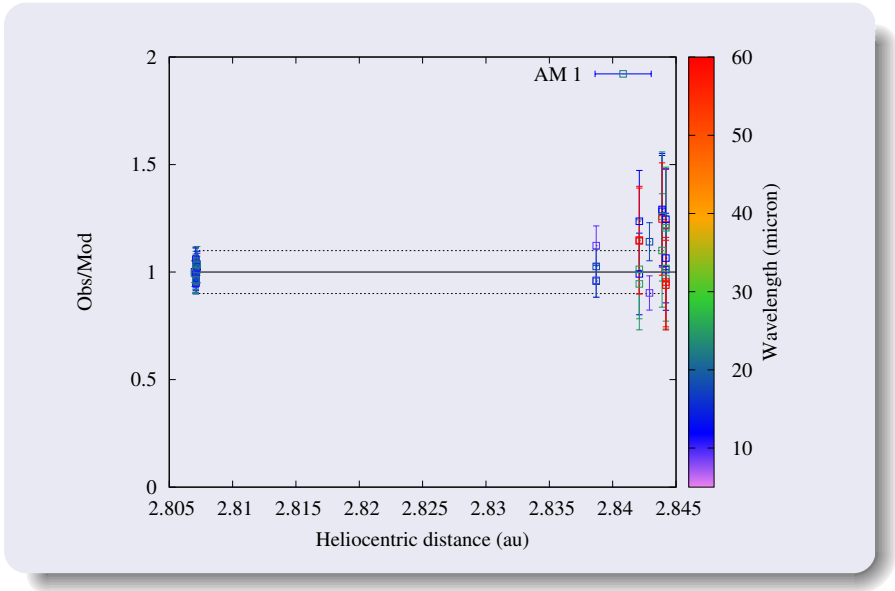


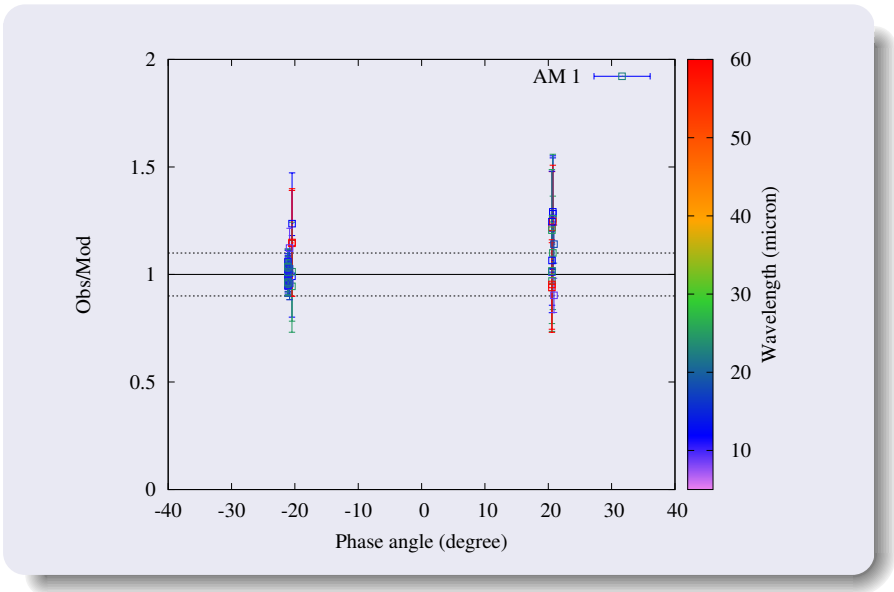
Thermal lightcurve fit to WISE W4 data (target: 673 Edda)

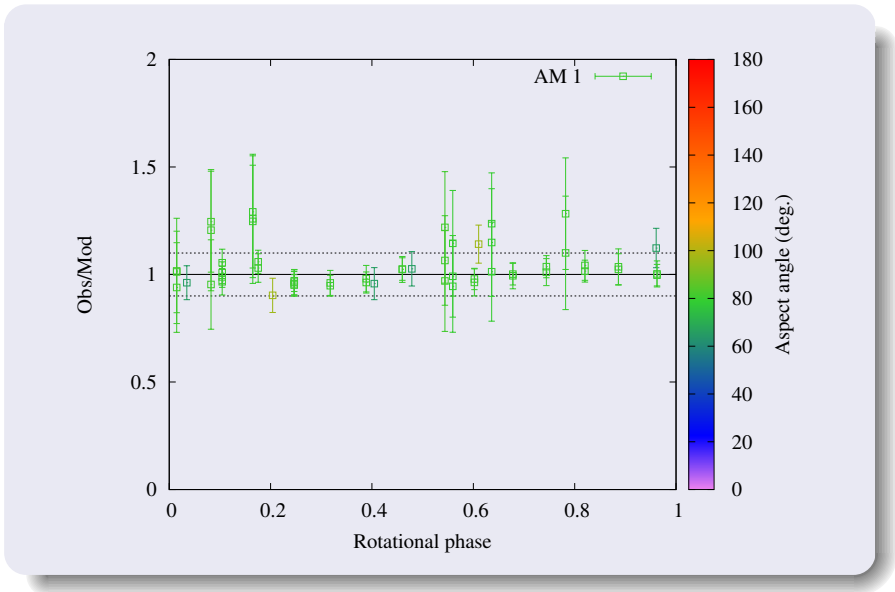


O-C plots for (673) Edda model applied in TPM







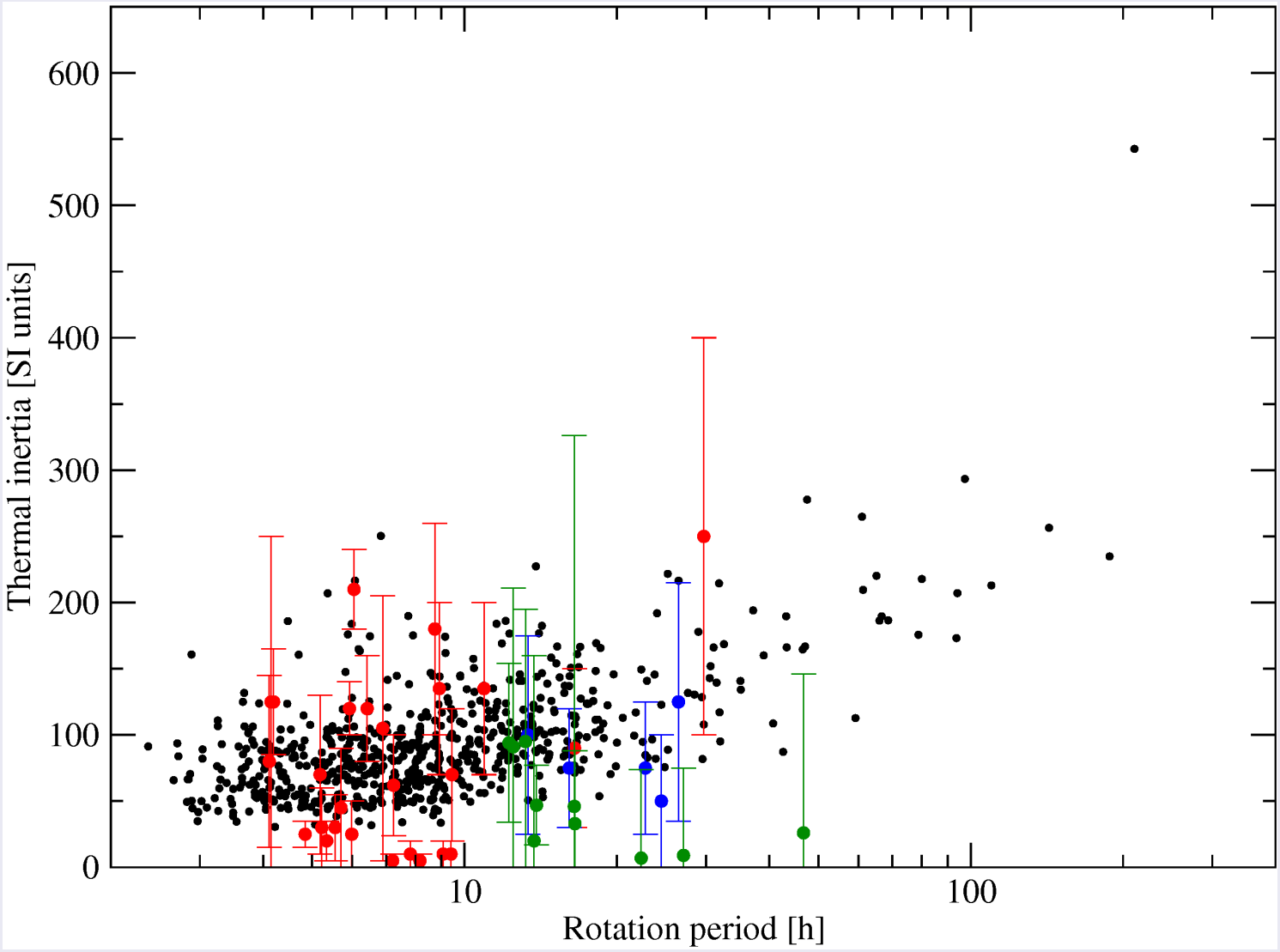


Summary of TPM results for (673) Edda.

Shape model	IR data subset	$\bar{\chi}^2_m$	$D \pm 3\sigma$ (km)	$\Gamma \pm 3\sigma$ (SIu)	Roughness (rms)
AM 1	All data	0.47	38^{+6}_{-2}	3^{+67}_{-3}	Med.-high (0.50)
AM 1 sphere	All data	1.83	38	5	Med.-high (0.39)
AM 2	All data	0.59	38^{2+}_{-2}	3^{+37}_{-3}	Extr. high (1.0)
AM 2 sphere	All data	1.76	38	10.	Medium (0.44)

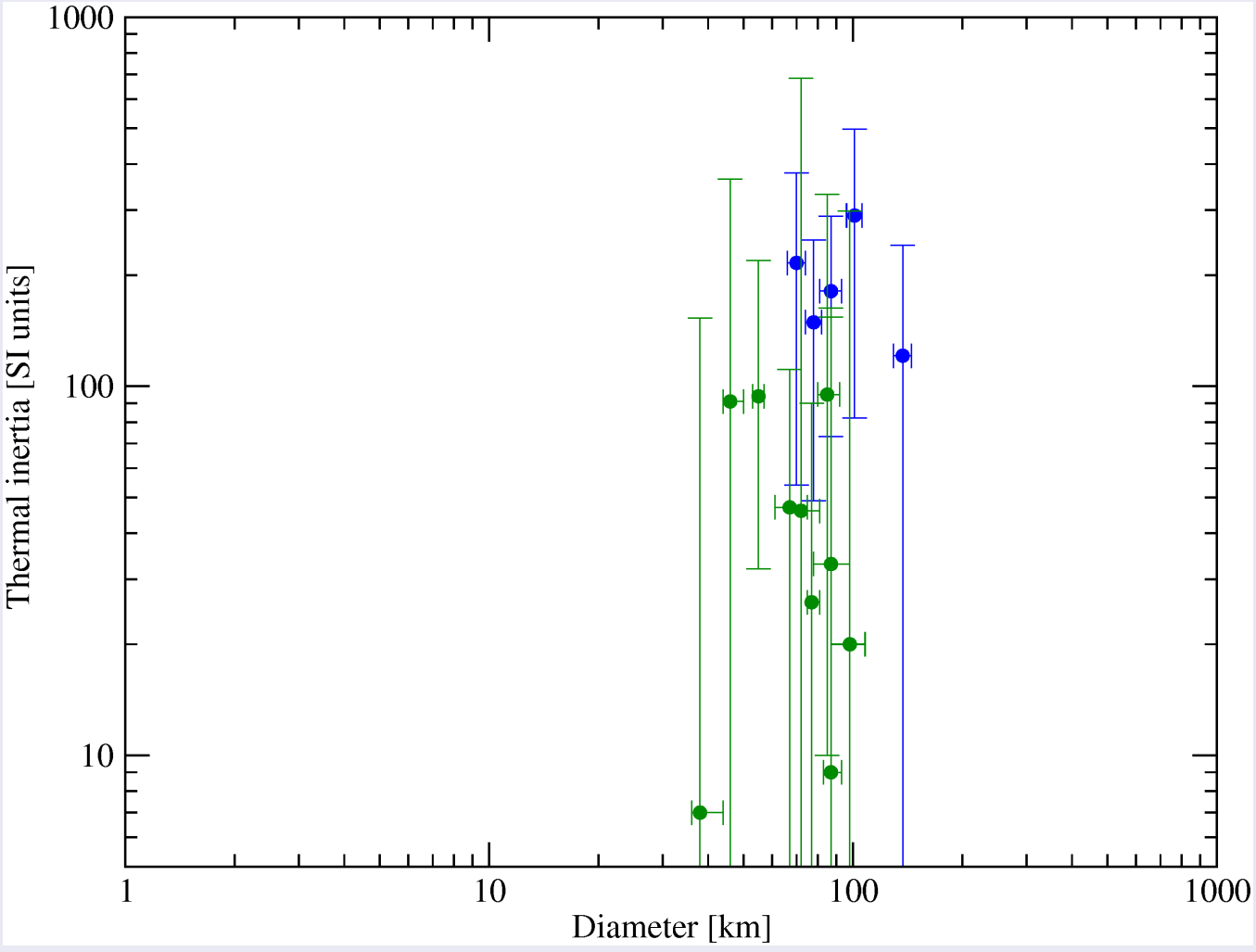
Target	Rotation period [h]	Taxonomic type	Radiometric solution for combined data. Diameter [km]	Albedo	Thermal inertia [SI units]
100 Hekate	27.07027 ±0.00006	S	87^{+5}_{-4}	$0.22^{+0.03}_{-0.03}$	4^{+66}_{-2}
109 Felicitas	13.190550 ±0.000004	Ch	85^{+7}_{-5}	$0.065^{+0.008}_{-0.01}$	40^{+100}_{-36}
195 Eurykleia	16.52178 ±0.00002	Ch	87^{+11}_{-9}	0.06±0.02	15^{+55}_{-15}
301 Bavaria	12.24090 ±0.00001	C	55^{+2}_{-2}	$0.047^{+0.004}_{-0.003}$	45^{+60}_{-30}
335 Roberta	12.02713 ±0.00003	B	98^{+10}_{-11}	$0.046^{+0.014}_{-0.008}$	unconstrained
380 Fiducia	13.71723 ±0.00002	C	72^{+9}_{-5}	$0.057^{+0.009}_{-0.012}$	10^{+140}_{-10}
468 Lina	16.47838 ±0.00003	CPF	69^{+11}_{-4}	$0.052^{+0.006}_{-0.014}$	20^{+280}_{-20}
538 Friederike	46.739 ±0.001	C	77^{+4}_{-2}	0.06±0.01	10^{+25}_{-10}
653 Berenike	12.48357 ±0.00003	K	46^{+4}_{-2}	$0.18^{+0.02}_{-0.03}$	40^{+120}_{-40}
673 Edda	22.33411 ±0.00004	S	38^{+6}_{-2}	$0.13^{+0.03}_{-0.05}$	3^{+67}_{-3}
834 Burnhamia	13.87594 ±0.00002	GS	67^{+8}_{-6}	$0.074^{+0.014}_{-0.016}$	20^{+30}_{-20}

Thermal inertia of slow rotators



after: Harris & Drube 2016

Thermal inertia normalised to 1 AU vs. size



Summary

- Selection effects: spin and shape models mainly available for short-period, elongated asteroids with extreme obliquities
- Biased spatial spin axis and size-frequency distributions, lack of detailed models for slow rotators
- Our targeted survey of 100 long-period, low-amplitude MB asteroids. Gathered over 10 000 hours of lightcurve data in 20 stations worldwide (+ Kepler).
- Modelled 16 targets from this sample, scaled by TPM using IR data from IRAS, AKARI and WISE
- Found high, medium and very low thermal inertias
- Differences due to sub-surface temperatures and different material properties?
- Indication of fresh and old surfaces connected with formation age and/or size?

This work was supported by grant no. 2014/13/D/ST9/01818 from National Science Centre, Poland.

Small Bodies Near And Far

The research leading to these results has received funding from the European Union's Horizon 2020 Research and Innovation Programme, under Grant Agreement no 687378.