Icarus 221 (2012) 365–387

Contents lists available at SciVerse ScienceDirect

Icarus

journal homepage: www.elsevier.com/locate/icarus

Absolute magnitudes of asteroids and a revision of asteroid albedo estimates from WISE thermal observations

Petr Pravec [a,*], Alan W. Harris [b], Peter Kušnirák [a], Adrián Galád [a,c], Kamil Hornoch [a]

[a] Astronomical Institute, Academy of Sciences of the Czech Republic, Fričova 1, CZ-25165 Ondřejov, Czech Republic
[b] 4603 Orange Knoll Avenue, La Cañada, CA 91011, USA
[c] Modra Observatory, Department of Astronomy, Physics of the Earth, and Meteorology, FMFI UK, Bratislava SK-84248, Slovakia

ARTICLE INFO

Article history:
Received 27 February 2012
Revised 27 July 2012
Accepted 28 July 2012
Available online 13 August 2012

Keywords:
Asteroids
Photometry
Infrared observations

ABSTRACT

We obtained estimates of the Johnson V absolute magnitudes (H) and slope parameters (G) for 583 main-belt and near-Earth asteroids observed at Ondřejov and Table Mountain Observatory from 1978 to 2011. Uncertainties of the absolute magnitudes in our sample are <0.21 mag, with a median value of 0.10 mag. We compared the H data with absolute magnitude values given in the MPCORB, Pisa AstDyS and JPL Horizons orbit catalogs. We found that while the catalog absolute magnitudes for large asteroids are relatively good on average, showing only little biases smaller than 0.1 mag, there is a systematic offset of the catalog values for smaller asteroids that becomes prominent in a range of H greater than ~10 and is particularly big above $H \sim 12$. The mean $(H_{\text{catalog}} - H)$ value is negative, i.e., the catalog H values are systematically too bright. This systematic negative offset of the catalog values reaches a maximum around $H = 14$ where the mean $(H_{\text{catalog}} - H)$ is -0.4 to -0.5. We found also smaller correlations of the offset of the catalog H values with taxonomic types and with lightcurve amplitude, up to ~0.1 mag or less. We discuss a few possible observational causes for the observed correlations, but the reason for the large bias of the catalog absolute magnitudes peaking around $H = 14$ is unknown; we suspect that the problem lies in the magnitude estimates reported by asteroid surveys. With our photometric H and G data, we revised the preliminary *WISE* albedo estimates made by Masiero et al. (Masired, J.R. et al. [2011]. Astrophys. J. 741, 68–89) and Mainzer et al. (Mainzer, A. et al. [2011b]. Astrophys. J. 743, 156–172) for asteroids in our sample. We found that the mean geometric albedo of Tholen/Bus/DeMeo C/G/B/F/P/D types with sizes of 25–300 km is $p_V = 0.057$ with the standard deviation (dispersion) of the sample of 0.013 and the mean albedo of S/A/L types with sizes 0.6–200 km is 0.197 with the standard deviation of the sample of 0.051. The standard errors of the mean albedos are 0.002 and 0.006, respectively; systematic observational or modeling errors can predominate over the quoted formal errors. There is apparent only a small, marginally significant difference of 0.031 ± 0.011 between the mean albedos of sub-samples of large and small (divided at diameter 25 km) S/A/L asteroids, with the smaller ones having a higher albedo. The difference will have to be confirmed and explained; we speculate that it may be either a real size dependence of surface properties of S type asteroids or a small size-dependent bias in the data (e.g., a bias towards higher albedos in the optically-selected sample of asteroids). A trend of the mean of the preliminary *WISE* albedo estimates increasing with asteroid size decreasing from $D \sim 30$ down to ~5 km (for S types) showed in Mainzer et al. (Mainzer, A. et al. [2011a]. Astrophys. J. 741, 90–114) appears to be mainly due to the systematic bias in the MPCORB absolute magnitudes that progressively increases with H in the corresponding range $H = 10$–14.

1. Introduction

Diameters and albedos of asteroids are one of their most basic physical parameters. Asteroid diameters can be estimated with several direct or indirect techniques. Direct size estimation techniques include in situ spacecraft observations, resolved imaging with adaptive optics systems or radar observations, and asteroid occultations of stars. However, use of the direct techniques is limited mostly to large asteroids or those making close approaches to the Earth. Indirect techniques of asteroid size estimation are polarimetry, from which one determines albedo and with an absolute magnitude value can compute a diameter, and asteroid thermal modeling with observations of their thermal infrared and visual fluxes; the effective diameter and visual geometric albedo are parameters of asteroid thermal models. This latter technique has

---

[*] Corresponding author. Fax: +420 323 620263.
E-mail address: ppravec@asu.cas.cz (P. Pravec).

0019-1035/$ - see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.icarus.2012.07.026

been applied to large samples of asteroids covering a broad range of sizes.

Ideally, both the integral thermally emitted infrared and the integral reflected optical fluxes should be measured simultaneously. In practice, however, thermal observations are normally made at a single or over a limited range of aspects, and it has become a normal practice for asteroid thermal modellers to estimate the integral optical flux from the asteroid's absolute visual magnitude *H* and a model of its phase function.[1] The absolute magnitude of a Solar System object is defined as the apparent magnitude of the object illuminated by the solar light flux at 1 AU and observed from a distance of 1 AU and at zero solar phase angle (the angle between the asteroid–observer and the asteroid–Sun lines).

Absolute magnitudes of asteroids are estimated from their photometric observations. As the observations are generally taken at non-zero solar phase angles, an estimation of *H* involves an estimation of the dependence of the asteroid brightness on the phase angle. The dependence is most often modeled with the *H*–*G* phase relation (Bowell et al., 1989) that has conveniently only two free parameters, the absolute magnitude *H* and the slope parameter *G*. The systematic model error of the *H*–*G* phase relation is on an order of a few 0.01 mag (Harris, 1989).

Thermal infrared survey observations by the *Infrared Astronomical Satellite (IRAS)*, the *Wide-field Infrared Survey Explorer (WISE)*, AKARI and the *Spitzer Space Telescope* resulted in estimates of diameters and albedos for thousands of asteroids (e.g., Tedesco et al., 2002; Mainzer et al., 2011a,b; Masiero et al., 2011; Usui et al., 2011; Ryan and Woodward, 2011). They used the absolute magnitude values from the asteroid orbit catalogs MPCORB[2] or AstOrb.[3] Most of the absolute magnitudes in the catalogs were derived from magnitude estimates reported by visual asteroid surveys and follow-up observers with their astrometric observations. The procedures that most of the astrometric surveys, follow-up observers, and orbit calculators used for estimating the asteroid apparent magnitudes and derivation of the *H* values have not been comprehensively published so far.

Given the principal importance of asteroid absolute magnitude data for the estimation of their diameters and albedos and considering that the accuracy of and biases present in the *H* values in the orbit catalogs have not been satisfactorily characterized so far,[4] we investigated them by comparing the catalog *H* values with our absolute magnitude estimates for a sample of 583 main-belt and near-Earth asteroids that we observed photometrically within our asteroid lightcurve observations projects over the past 33 years.

2. Absolute magnitudes *H* data sample

Our sample consists of absolute magnitude estimates that we derived from our photometric observations of asteroids made from Ondřejov Observatory, Czech Republic, and Table Mountain Observatory, California, from 1978 to 2011. The observations were made within our projects aimed at estimation of the spins, shapes, and binary nature of asteroids in the main belt and on inner-planet crossing orbits. About half of the *H* data in our sample we published in a series of papers (listed below Table 2). The rest is new data that we derived more recently. Most of the observations of asteroids in our sample were targeted observations—the asteroids were selected and observed deliberately for particular aims of the specific photometric projects. A fraction (96 of the 583) were, however, accidental observations of asteroids that happened to be present in the imaged fields of the targeted asteroids. Our target selection procedures favored certain types of heliocentric orbits, namely near-Earth and inner main-belt (including Hungarias), but they were blind to other asteroid parameters such as visible color or discovery stations/circumstances. The accidentally observed asteroids were not selected even for heliocentric orbits of course; more than a half of them were central and outer main-belt asteroids. We outline our observational and reduction procedures in the following paragraphs.

2.1. Absolute calibrations in the Johnson–Cousins BVRI system

We made the observations primarily through the *V* or *R* filters and calibrated them in the Johnson–Cousins system using the Landolt standard stars (Landolt, 1973, 1983, 1992) with the all-sky photometry method on photometric nights. We observed some of the asteroids also in other than just the primary filter and in such cases we estimated their actual color indices. However, many of the asteroids were observed in only the primary filter, *R* in the case of the Ondřejov observations, as with CCD cameras we achieved a higher signal-to-noise ratio and a lower atmospheric extinction compared to the *V* band. The spectral transmission curve of the *R* filter was designed for a given CCD so that the resulting spectral response of the telescope + filter + CCD combination matched closely the Cousins R passband as defined in Bessell (1990); the coefficient of the color term, in which we use $(V - I)$, in the photometric transformation function of the telescope system was always within 0.05 of zero. With such a filter + CCD setup, we were able to calibrate the asteroid photometric observations in the Cousins *R* system assuming $(V - I)$ of 0.80, which is about the average asteroidal color index, with a systematic error <0.01 mag; the most common C and S asteroid types have a mean $(V - I)$ of 0.73 and 0.90, respectively (Shevchenko and Lupishko, 1998). With the use of several Landolt standard stars for the calibrations on each photometric night, we defined the magnitude system's zero point with accuracy of 0.01 mag.

2.2. Mean brightness level estimation

For derivation of the mean absolute magnitude *H* of an asteroid, corresponding to its mean cross-section, we need to estimate its mean reduced magnitude: the asteroid's apparent magnitude reduced to unit geo- and heliocentric distances and to a phase angle close to the mid-range of solar phases covered by the observations. In most cases, we estimated the mean reduced magnitude as the zeroth order of the 1-period (or 2-period, for tumblers) Fourier series, or two additive 1-period Fourier series in the case of a binary asteroid where lightcurves of both the primary and the secondary components were observed, fitted to the photometric observations made over one or more nearby nights that covered the rotation lightcurve sufficiently (see the references below Table 2 for details of the technique). An uncertainty of the mean reduced magnitude estimated in these cases was mostly <0.01 mag. In a small fraction of asteroids in our sample, mostly some long-period ones, we did not obtain sufficient data to get an accurate Fourier series fit. In these cases, we estimated the asteroid's mean brightness either as the mean value of a range in which the Fourier series zeroth order lie for a range of possible and plausible fits to the observations, or as an average of the observations made during one or more nearby nights in cases where even a range of possible Fourier series fits could not be obtained. Even in these cases with limited or no Fourier fits available, the resulted mean magnitude estimate had

---

[1] Throughout this paper, we use *H* for the absolute magnitude in Johnson *V* band, H_V.

[2] http://www.minorplanetcenter.org/iau/MPCORB.html.

[3] ftp://ftp.lowell.edu/pub/elgb/astorb.html.

[4] Actually, we had a suspicion that there is present a significant bias in the orbit catalog *H* data for many years already. We and other observers noticed that our photometric observations of asteroids smaller than about 20 km typically showed them being fainter than predicted using the catalog *H* values. Results from three earlier papers showing the offset by comparing the catalog magnitudes with data from the Sloan Digital Sky Survey are presented in Section 3.4.

an uncertainty <0.2 mag for all the asteroids included in our sample. Specifically, in cases where there are cycle ambiguities, the mean magnitude level is still well determined and introduces negligible error in H. In some large amplitude cases where we do not fully define minima, the uncertainty can be as much as 0.2 mag, but usually less; minima of a high-amplitude lightcurve tend to be narrow and do not change the mean magnitude by much. Finally, for cases where we observe for a few nights and see little if any variation, an uncertainty of the mean magnitude estimated as an average of the observations is unlikely to be greater than 0.2 mag for a distribution of the maximum–mean magnitude differences in asteroid lightcurves. This procedure caused a certain bias against high amplitude asteroids in our sample; we discuss a resulting small systematic error that it could cause in the derived mean offset of catalog H values in Section 3.3.

2.3. Reduction to zero phase angle

The absolute magnitude H is defined as the reduced magnitude at zero phase angle. The mean magnitudes observed at non-zero phase angles were reduced to zero phase using the H–G phase relation. For about one third of our observed asteroids, we got sufficient data to estimate the slope parameter G from the observations. For the rest, we assumed G based on their taxonomic classification where available and conclusive, or on their orbital group membership. The assumed default G values were taken from Tables 2 and 3 of Warner et al. (2009) in most cases.[5] For some H estimates that we published before (see the references in Table 2), we assumed slightly different default values of G based on earlier works, e.g., 0.23 ± 0.11 instead of the new default 0.24 ± 0.11 for S types, or 0.09 ± 0.09 instead of the new default 0.12 ± 0.08 for C types; we kept those earlier estimates in such cases as the differences are minor and well within the uncertainties. The uncertainties of the assumed default G values were propagated to the estimated uncertainties of the resulting H values.

The uncertainties in G were the most significant source of uncertainty for the H estimates for many asteroids in our sample. As we aimed to get H values with uncertainties not greater than 0.2 mag, we limited our sample to include asteroids that were observed at solar phases not greater than ~30°, which gave an uncertainty in resulting H of ±0.16 and ±0.14 for the default G of S and C types, respectively, with only a few exceptions in justified cases.

2.4. Derivation of H from H_R

Most of the Ondřejov observations were taken in the Cousins R. We transformed the estimated H_R values to H by adding the mean color index $(V - R)$ for the known or assumed (according to its orbital group membership) taxonomic class of a given asteroid. The mean color indices for the major classes S, C and M (X) in the taxonomic system of Tholen (1984, 1989) were taken from Shevchenko and Lupishko (1998) who analysed direct measurements of the asteroid color indices in the Johnson–Cousins photometric system. For other, smaller classes Q, A, D, Xc, Xe and V in the Bus–DeMeo taxonomy, we derived the mean color index from the mean reflectance spectrum of a given class provided by DeMeo et al. (2009), assuming solar $(V - R) = 0.367$. The mean $(V - R)$ values are listed in Table 1. For three asteroids with an ambiguous classification of S or A, we assumed $(V - R) = 0.528 \pm 0.05$ which is the average of the mean color indices for the two classes. For asteroids with unknown spectral class, we used the mean $(V - R)$ for a class predominating in their respective orbital group according to Table 2 of Warner et al. (2009). We note that our $(V - R)$ estimates derived from the mean spectra for the Bus–DeMeo classes are in agreement with the color indices for the analogous Tholen classes derived from the mean colors in the eight-color asteroid survey for their specific CCD and filter responses by Dandy et al. (2003) for all but the V class. The V-type broad-band color depends critically on the exact R passband as there is the deep pyroxene band in the far red, which may explain their different $(V - R)$ estimate.

Table 1
Mean color indices $(V - R)$ used for conversion of H_R to H.

Class	$(V - R)$	Reference
S	0.49 ± 0.05	Shevchenko and Lupishko (1998)
Q	0.454 ± 0.023	From mean Q spectrum by DeMeo et al. (2009)
A	0.567 ± 0.023	From mean A spectrum by DeMeo et al. (2009)
C	0.38 ± 0.05	Shevchenko and Lupishko (1998)
D	0.455 ± 0.033	From mean D spectrum by DeMeo et al. (2009)
T	0.442 ± 0.011	From mean T spectrum by DeMeo et al. (2009)
X	0.42 ± 0.04	Shevchenko and Lupishko (1998)
Xc	0.408 ± 0.008	From mean Xc spectrum by DeMeo et al. (2009)
Xe	0.453 ± 0.037	From mean Xe spectrum by DeMeo et al. (2009)
V	0.516 ± 0.037	From mean V spectrum by DeMeo et al. (2009)

2.5. Averaging H estimates from different apparitions

For 38 of the 583 asteroids in our sample, we have got more than one H estimate, mostly from observations made in different apparitions. In all but one of the cases, we computed the mean H value as a weighted mean of the individual estimates, with weights of δH^{-2}. The exception was (1866) Sisyphus where the two H estimates differ by 0.38 mag which we suspect is due to different cross-sections at the two different aspects of the asteroid in the two apparitions rather than due to uncertainties of the H estimates; we used a simple average of the two values, i.e., assumed equal weights.

2.6. Uncertainties of the H estimates

We estimated the uncertainties δH of our absolute magnitude estimates by propagating the uncertainties resulting from the individual error sources mentioned above. The H–G model error (see Harris, 1989; also in Section 1) was assumed to be 0.03 mag; this model uncertainty was quadratically added in the computation of δH as well. All the H estimates in our sample have $\delta H < 0.21$ mag. We accounted for all major uncertainty sources in the H estimation, so our δH are realistic uncertainties for the absolute magnitudes measured at the observed aspects of the asteroids. We note, however, that an asteroid generally has different H values at different aspects. The difference depends on the asteroid's shape and its rotation pole position. Analysing the data for a sample of large asteroids by Drummond et al. (1988, 1991) who derived dependences of their H values on observing aspect, we estimated the median dispersion of the observed H values of 0.07 mag. The aspect-related uncertainty must be accounted for when the H value estimated from observations made at a specific aspect is used for other observations made at a different aspect. A simple way could be to quadratically add 0.07 mag to our δH to get an estimate of the absolute error in H if our values are used for a general aspect of the asteroid. A full account of the aspect-related changes of H will need photometric data from a few different aspects and a pole/shape modeling.

The estimated absolute magnitudes, their uncertainties, estimated or assumed slope parameter values and mean lightcurve amplitudes are listed in Table 2.

---

[5] In Warner et al. (2009), the asteroid groups/families were defined according to http://www.projectpluto.com/mp_group.htm.

Table 2
H data.

Asteroid	H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{MPC}-H$	$H_{AsD}-H$	$H_{JPL}-H$	Ampl.	Reference(s)
3 Juno	5.280	0.050			0.320	0.040	5.33	0.32	5.37	0.32	5.33	0.32	0.050	0.090	0.050	0.15	2
8 Flora	6.560	0.114			0.320	0.110	6.49	0.28	6.56	0.28	6.49	0.28	−0.070	0.000	−0.070	0.08	1
9 Metis	6.330	0.124			0.230	0.110)	6.30	0.15	6.25	0.17	6.28	0.17	−0.030	−0.080	−0.050	0.20	1
11 Parthenope	6.570	0.042			0.240	0.030	6.55	0.15	6.57	0.15	6.55	0.15	−0.020	0.000	−0.020	0.05	3
12 Victoria	7.060	0.032			0.220	0.020)	7.24	0.22	7.21	0.22	7.24	0.22	0.180	0.150	0.180	0.08	4
16 Psyche	5.930	0.067			0.210	0.060)	5.90	0.20	6.02	0.20	5.90	0.20	−0.030	0.090	−0.030	0.21	4
17 Thetis	7.900	0.104			0.230	0.110)	7.76	0.15	7.71	0.15	7.76	0.15	−0.140	−0.190	−0.140	0.28	3
19 Fortuna	7.152	0.036			0.162	0.030	7.20	0.15	7.21	0.10	7.13	0.10	0.048	0.058	−0.022	0.23	3, 4
24 Themis	7.088	0.031			0.180	0.020	7.20	0.15	7.21	0.19	7.08	0.19	0.112	0.122	−0.008	0.09	2
30 Urania	7.530	0.036			0.230	0.060	7.60	0.15	7.59	0.15	7.53	0.15	0.070	0.060	0.000	0.11	12
31 Euphrosyne	6.700	0.050			0.090	0.090)	6.80	0.15	6.78	0.15	6.74	0.15	0.100	0.080	0.040	0.05	1
33 Polyhymnia	8.564	0.031			0.340	0.020	8.50	0.15	8.63	0.33	8.55	0.33	−0.064	0.066	−0.014	0.20	1
37 Fides	7.328	0.031			0.270	0.007	7.29	0.24	7.39	0.24	7.29	0.24	−0.038	0.062	−0.038	0.13	1
38 Leda	8.315	0.050			0.090	0.090)	8.40	0.15	8.36	0.15	8.32	0.15	0.085	0.045	0.005	0.10	1, 4
45 Eugenia	7.422	0.030			0.130	0.006	7.50	0.15	7.44	0.07	7.46	0.07	0.078	0.018	0.038	0.18	4
46 Hestia	8.400	0.036			0.120	0.040	8.50	0.15	8.38	0.06	8.36	0.06	0.100	−0.020	−0.040	0.08	4
47 Aglaja	7.861	0.031			0.178	0.020	8.00	0.15	8.01	0.16	7.84	0.16	0.139	0.149	−0.021	0.02	1
53 Kalypso	8.660	0.050			0.090	0.090)	8.80	0.15	8.81	0.15	8.81	0.15	0.140	0.150	0.150	0.05	1
57 Mnemosyne	7.090	0.036			0.220	0.040	7.03	0.15	6.89	0.15	7.03	0.15	−0.060	−0.200	−0.060	0.11	3
58 Concordia	8.860	0.104			0.090	0.090)	8.90	0.15	8.96	0.15	8.86	0.15	0.040	0.100	0.000	0.10	3
60 Echo	8.484	0.031			0.250	0.005	8.21	0.27	8.52	0.27	8.21	0.27	−0.274	0.036	−0.274	0.11	2
62 Erato	8.600	0.104			0.090	0.090)	8.70	0.15	8.61	0.15	8.76	0.15	0.100	0.010	0.160	0.20	3
70 Panopaea	8.100	0.067			0.130	0.100	8.00	0.15	8.01	0.14	8.11	0.14	−0.100	−0.090	0.010	0.10	1
71 Niobe	7.310	0.095			0.400	0.140	7.30	0.40	7.31	0.40	7.30	0.40	−0.010	0.000	−0.010	0.11	1
72 Feronia	8.790	0.032			0.000	0.010	8.94	0.15	8.99	0.15	8.94	0.15	0.150	0.200	0.150	0.11	3
75 Eurydike	8.970	0.032			0.230	0.020	8.96	0.23	8.96	0.23	8.96	0.23	−0.010	−0.010	−0.010	0.10	1
76 Freia	7.864	0.031			0.070	0.010	7.90	0.15	7.92	0.15	7.90	0.15	0.036	0.056	0.036	0.10	3
77 Frigga	8.522	0.031			0.160	0.010	8.60	0.15	8.55	0.16	8.52	0.16	0.078	0.028	−0.002	0.07	1
78 Diana	8.018	0.030			0.080	0.009	8.09	0.08	8.13	0.08	8.09	0.08	0.072	0.112	0.072	0.02	1
88 Thisbe	7.030	0.143			0.090	0.090)	7.10	0.15	7.19	0.14	7.04	0.14	0.070	0.160	0.010	0.10	3
93 Minerva	7.504	0.042			−0.006	0.030	7.80	0.15	7.80	0.15	7.70	0.15	0.296	0.296	0.196	0.06	1, 4
96 Aegle	7.650	0.076			0.090	0.090)	7.60	0.15	7.59	0.15	7.67	0.15	−0.050	−0.060	0.020	0.10	1
99 Dike	9.350	0.133			0.090	0.090)	9.50	0.15	9.44	0.15	9.43	0.15	0.150	0.090	0.080	0.20	3
101 Helena	8.327	0.030			0.320	0.010	8.20	0.15	8.32	0.35	8.33	0.35	−0.127	−0.007	0.003	0.11	1
102 Miriam	9.300	0.202			0.090	0.090)	9.30	0.15	9.27	0.15	9.26	0.15	0.000	−0.030	−0.040	0.16	3
106 Dione	7.410	0.067			0.090	0.090)	7.41	0.15	7.50	0.15	7.41	0.15	0.000	0.090	0.000	0.10	3
107 Camilla	7.100	0.036			0.090	0.090)	7.10	0.15	7.06	0.08	7.08	0.08	0.000	−0.040	−0.020	0.41	1
109 Felicitas	8.759	0.031			0.030	0.008	8.90	0.15	8.74	0.04	8.75	0.04	0.141	−0.019	−0.009	0.06	1
114 Kassandra	8.275	0.036			0.090	0.090)	8.20	0.15	8.23	0.15	8.26	0.15	−0.075	−0.045	−0.015	0.12	1, 3
125 Liberatrix	8.900	0.036			0.220	0.090	8.80	0.15	8.91	0.33	9.04	0.33	−0.100	0.010	0.140	0.30	3
127 Johanna	8.370	0.124			0.090	0.090)	8.30	0.15	8.45	0.15	8.30	0.15	−0.070	0.080	−0.070	0.18	4
130 Elektra	6.990	0.050			0.090	0.090)	7.12	0.15	7.00	0.15	7.12	0.15	0.130	0.010	0.130	0.32	1
132 Aethra	9.200	0.153			0.210	0.060)	9.38	0.15	8.94	0.15	9.21	0.15	0.180	−0.260	0.010	0.24	12
133 Cyrene	7.990	0.033			0.130	0.020	7.90	0.15	7.90	0.13	7.98	0.13	−0.090	−0.090	−0.010	0.26	1
134 Sophrosyne	8.770	0.032			0.280	0.020	8.76	0.28	8.75	0.28	8.76	0.28	−0.010	−0.020	−0.010	0.18	1
135 Hertha	8.100	0.050			0.240	0.040	8.23	0.15	8.16	0.15	8.23	0.15	0.130	0.060	0.130	0.12	3
137 Meliboea	8.100	0.058			0.090	0.090)	8.10	0.15	8.01	0.15	8.05	0.15	0.000	−0.090	−0.050	0.10	1
139 Juewa	7.924	0.032			0.150	0.010	7.90	0.15	7.89	0.15	7.78	0.15	−0.024	−0.034	−0.144	0.18	4
144 Vibilia	7.920	0.036			0.170	0.040	8.00	0.15	8.03	0.17	7.91	0.17	0.080	0.110	−0.010	0.14	1
145 Adeona	8.050	0.076			0.090	0.090)	8.10	0.15	8.08	0.15	8.13	0.15	0.050	0.030	0.080	0.04	1
146 Lucina	8.277	0.036			0.186	0.030	8.20	0.11	8.24	0.11	8.20	0.11	−0.077	−0.037	−0.077	0.14	1, 4
148 Gallia	7.400	0.104			0.090	0.090)	7.63	0.15	7.61	0.15	7.63	0.15	0.230	0.210	0.230	0.07	3
154 Bertha	7.530	0.085			0.090	0.090)	7.60	0.15	7.61	0.15	7.58	0.15	0.070	0.080	0.050	0.20	1
156 Xanthippe	8.310	0.095			−0.120	0.080	8.60	0.15	8.64	0.15	8.64	0.15	0.290	0.330	0.330	0.11	1
159 Aemilia	8.100	0.104			0.090	0.090)	8.20	0.15	8.25	0.15	8.12	0.15	0.100	0.150	0.020	0.20	1
160 Una	9.050	0.030			0.050	0.040	9.00	0.15	9.08	0.15	9.08	0.15	−0.050	0.030	0.030	0.10	4
161 Athor	9.080	0.032			0.130	0.020	9.00	0.15	8.97	0.13	9.15	0.13	−0.080	−0.110	0.070	0.12	1
163 Erigone	9.480	0.032			−0.040	0.010	9.70	0.15	9.44	−0.04	9.47	−0.04	0.220	−0.040	−0.010	0.37	1
165 Loreley	7.710	0.032			0.070	0.010	7.70	0.15	7.68	0.15	7.65	0.15	−0.010	−0.030	−0.060	0.12	3
166 Rhodope	9.750	0.058			0.090	0.090)	9.80	0.15	9.81	0.15	9.89	0.15	0.050	0.060	0.140	0.13	4
178 Belisana	9.600	0.031			0.310	0.009	9.40	0.15	9.35	0.15	9.38	0.15	−0.200	−0.250	−0.220	0.18	3
187 Lamberta	7.980	0.050			−0.040	0.040	8.20	0.15	8.08	0.15	8.16	0.15	0.220	0.100	0.180	0.32	4
189 Phthia	9.600	0.104			0.230	0.110)	9.20	0.15	9.24	0.15	9.33	0.15	−0.400	−0.360	−0.270	0.20	3
201 Penelope	8.540	0.036			0.170	0.020	8.30	0.15	8.40	0.24	8.43	0.24	−0.240	−0.140	−0.110	0.56	1
211 Isolda	7.900	0.042			0.120	0.040	8.00	0.15	7.89	0.12	7.89	0.12	0.100	−0.010	−0.010	0.09	1
212 Medea	8.180	0.067			0.090	0.090)	8.30	0.15	8.27	0.15	8.28	0.15	0.120	0.090	0.100	0.08	4
216 Kleopatra	7.350	0.036			0.280	0.030	7.10	0.15	7.17	0.29	7.30	0.29	−0.250	−0.180	−0.050	0.68	1
218 Bianca	8.607	0.030			0.310	0.008	8.60	0.32	8.60	0.32	8.60	0.32	−0.007	−0.007	−0.007	0.11	1
219 Thusnelda	9.340	0.058			0.230	0.110)	9.32	0.15	9.21	0.15	9.32	0.15	−0.020	−0.130	−0.020	0.19	3
226 Weringia	9.820	0.076			0.230	0.110)	9.80	0.15	9.81	0.15	9.70	0.15	−0.020	−0.010	−0.120	0.10	1
230 Athamantis	7.346	0.030			0.272	0.003	7.35	0.27	7.44	0.27	7.35	0.27	0.004	0.094	0.004	0.19	1, 3
236 Honoria	8.188	0.031			−0.020	0.014	8.20	0.15	7.97	−0.02	8.18	−0.02	0.012	−0.218	−0.008	0.17	1
258 Tyche	8.500	0.036			0.230	0.020	8.50	0.23	8.39	0.23	8.50	0.23	0.000	−0.110	0.000	0.39	1
261 Prymno	9.440	0.032			0.190	0.030	9.44	0.19	9.35	0.19	9.44	0.19	0.000	−0.090	0.000	0.17	2

Table 2 (*continued*)

Asteroid	H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{\mathrm{MPC}} - H$	$H_{\mathrm{AsD}} - H$	$H_{\mathrm{JPL}} - H$	Ampl.	Reference(s)
266 Aline	8.490	0.076			0.090	0.090)	8.80	0.15	8.61	0.15	8.80	0.15	0.310	0.120	0.310	0.07	4
279 Thule	8.520	0.182			0.150	0.200)	8.57	0.15	8.35	0.15	8.57	0.15	0.050	−0.170	0.050	0.04	10
284 Amalia	10.120	0.076			0.120	0.110	10.05	0.11	10.03	0.11	10.05	0.11	−0.070	−0.090	−0.070	0.15	1
288 Glauke	10.000	0.202			0.230	0.110)	9.70	0.15	9.67	0.15	9.84	0.15	−0.300	−0.330	−0.160	0.90	4
298 Baptistina	11.320	0.124			0.230	0.110)	11.20	0.15	11.15	0.15	11.00	0.15	−0.120	−0.170	−0.320	0.12	12
317 Roxane	10.070	0.032			0.490	0.040	9.70	0.15	9.69	0.15	10.03	0.15	−0.370	−0.380	−0.040	0.60	3
322 Phaeo	8.990	0.067			0.090	0.090)	9.00	0.15	8.99	0.15	9.01	0.15	0.010	0.000	0.020	0.07	1
325 Heidelberga	8.770	0.032			0.230	0.020	8.60	0.15	8.59	0.15	8.65	0.15	−0.170	−0.180	−0.120	0.19	3
326 Tamara	9.390	0.104			0.090	0.090)	9.30	0.15	9.29	0.15	9.36	0.15	−0.090	−0.100	−0.030	0.15	3
335 Roberta	8.860	0.042			0.130	0.030	8.96	0.15	9.03	0.15	8.96	0.15	0.100	0.170	0.100	0.09	3
338 Budrosa	8.370	0.032			0.230	0.020	8.50	0.15	8.44	0.15	8.50	0.15	0.130	0.070	0.130	0.06	3
344 Desiderata	8.030	0.050			0.090	0.090)	8.08	0.15	8.28	0.15	8.08	0.15	0.050	0.250	0.050	0.16	1
345 Tercidina	8.810	0.076			0.210	0.100	8.90	0.15	8.73	0.10	8.71	0.10	0.090	−0.080	−0.100	0.15	1
346 Hermentaria	7.250	0.042			0.230	0.110)	7.13	0.15	7.26	0.15	7.13	0.15	−0.120	0.010	−0.120	0.08	1, 3
347 Pariana	8.890	0.058			0.210	0.060)	8.90	0.15	8.91	0.15	8.90	0.15	0.010	0.020	0.010	0.09	12
367 Amicitia	10.690	0.143			0.230	0.110)	10.70	0.15	10.48	0.15	10.70	0.15	0.010	−0.210	0.010	0.28	12
375 Ursula	7.210	0.036			0.080	0.030	7.40	0.15	7.47	0.27	7.47	0.27	0.190	0.260	0.260	0.06	4
379 Huenna	8.990	0.032			0.140	0.010	8.80	0.15	8.81	0.15	8.87	0.15	−0.190	−0.180	−0.120	0.09	3
386 Siegena	7.400	0.032			0.100	0.020	7.43	0.16	7.79	0.16	7.43	0.16	0.030	0.390	0.030	0.07	1
387 Aquitania	7.440	0.036			0.020	0.020	7.60	0.15	7.55	0.15	7.41	0.15	0.160	0.110	−0.030	0.24	3
388 Charybdis	8.580	0.050			0.070	0.100	8.60	0.15	8.50	0.07	8.57	0.07	0.020	−0.080	−0.010	0.17	1
391 Ingeborg	10.900	0.202			0.230	0.110)	10.80	0.15	10.75	0.15	10.10	0.15	−0.100	−0.150	−0.800	0.22	12
392 Wilhelmina	9.590	0.032			0.090	0.090)	9.70	0.15	9.66	0.15	9.70	0.15	0.110	0.070	0.110	0.11	4
419 Aurelia	8.411	0.042			0.160	0.050	8.50	0.15	8.51	0.15	8.42	0.15	0.089	0.099	0.009	0.07	1
422 Berolina	10.950	0.032			0.420	0.080)	10.60	0.15	10.65	0.15	10.83	0.15	−0.350	−0.300	−0.120	0.10	1
423 Diotima	7.320	0.036			0.090	0.090)	7.30	0.15	7.17	0.15	7.24	0.15	−0.020	−0.150	−0.080	0.14	4
428 Monachia	11.740	0.058			0.010	0.040	12.00	0.15	11.88	0.15	11.74	0.15	0.260	0.140	0.000	0.31	12
429 Lotis	9.890	0.036			0.070	0.030	9.90	0.15	9.91	0.15	9.82	0.15	0.010	0.020	−0.070	0.24	3
432 Pythia	8.880	0.058			0.230	0.110)	8.84	0.15	8.85	0.15	8.84	0.15	−0.040	−0.030	−0.040	0.14	1
434 Hungaria	11.460	0.036			0.430	0.020	11.20	0.15	11.17	0.15	11.21	0.15	−0.260	−0.290	−0.250	0.57	4
443 Photographica	10.240	0.104			0.230	0.110)	10.10	0.15	10.05	0.15	10.28	0.15	−0.140	−0.190	0.040	0.30	4
449 Hamburga	9.430	0.032			0.090	0.090)	9.80	0.15	9.76	0.15	9.47	0.15	0.370	0.330	0.040	0.01	3
453 Tea	10.850	0.124			0.230	0.110)	10.40	0.15	10.36	0.15	10.86	0.15	−0.450	−0.490	0.010	0.37	12
464 Megaira	9.470	0.058			0.090	0.090)	9.52	0.15	9.60	0.15	9.52	0.15	0.050	0.130	0.050	0.08	1
478 Tergeste	7.960	0.058			0.230	0.110)	7.90	0.15	7.96	0.15	7.98	0.15	−0.060	0.000	0.020	0.20	1
482 Petrina	8.910	0.076			0.230	0.110)	8.90	0.15	8.76	0.15	8.84	0.15	−0.010	−0.150	−0.070	0.10	3
486 Cremona	10.880	0.095			0.230	0.110)	11.00	0.15	11.06	0.15	10.89	0.15	0.120	0.180	0.010	0.02	12
488 Kreusa	7.800	0.104			0.090	0.090)	7.90	0.15	7.86	0.15	7.81	0.15	0.100	0.060	0.010	0.20	1
505 Cava	8.640	0.036			0.010	0.010	8.70	0.15	8.50	−0.03	8.61	−0.03	0.060	−0.140	−0.030	0.24	4
510 Mabella	9.660	0.067			0.090	0.090)	9.70	0.15	9.69	0.15	9.73	0.15	0.040	0.030	0.070	0.30	1
512 Taurinensis	10.720	0.050			0.240	0.040	10.70	0.15	10.70	0.15	10.68	0.15	−0.020	−0.020	−0.040	0.13	3
517 Edith	9.520	0.032			0.150	0.050	9.50	0.15	9.41	0.15	9.35	0.15	−0.020	−0.110	−0.170	0.18	3
519 Sylvania	9.180	0.036			0.230	0.040	8.90	0.15	8.87	0.15	9.14	0.15	−0.280	−0.310	−0.040	0.40	4
539 Pamina	10.040	0.104			0.090	0.090)	9.70	0.15	9.96	0.15	9.70	0.15	−0.340	−0.080	−0.340	0.20	3
540 Rosamunde	10.740	0.133			0.230	0.110)	10.50	0.15	10.55	0.15	10.76	0.15	−0.240	−0.190	0.020	0.53	12
542 Susanna	9.640	0.091	9.150	0.076	0.240	0.110)	9.30	0.15	9.29	0.15	9.36	0.15	−0.340	−0.350	−0.280	0.10	10
556 Phyllis	9.520	0.050			0.200	0.040	9.56	0.15	9.45	0.15	9.56	0.15	0.040	−0.070	0.040	0.24	3
558 Carmen	9.170	0.042			0.210	0.060)	9.00	0.15	8.99	0.15	9.09	0.15	−0.170	−0.180	−0.080	0.20	1
560 Delila	10.800	0.067			0.090	0.090)	10.90	0.15	10.85	0.15	10.60	0.15	0.100	0.050	−0.200	0.10	3
584 Semiramis	8.610	0.036			0.310	0.020	8.71	0.24	8.56	0.24	8.71	0.24	0.100	−0.050	0.100	0.21	3
587 Hypsipyle	12.190	0.114			0.230	0.110)	11.90	0.15	11.84	0.15	12.70	0.15	−0.290	−0.350	0.510	0.39	12
593 Titania	9.290	0.036			0.060	0.020	9.30	0.15	9.21	0.06	9.28	0.06	0.010	−0.080	−0.010	0.25	1
606 Brangane	10.200	0.104			0.090	0.090)	10.20	0.15	10.21	0.15	10.38	0.15	0.000	0.010	0.180	0.18	3
622 Esther	10.240	0.153			0.230	0.110)	10.20	0.15	10.20	0.15	10.17	0.15	−0.040	−0.040	−0.070	0.15	3
674 Rachele	7.472	0.042			0.239	0.050	7.42	0.15	7.34	0.15	7.42	0.15	−0.052	−0.132	−0.052	0.15	1, 3
695 Bella	9.070	0.031			0.200	0.010	9.30	0.15	8.93	0.15	9.30	0.15	0.230	−0.140	0.230	0.33	3
699 Hela	11.830	0.114			0.230	0.110)	11.72	0.15	11.18	0.15	11.72	0.15	−0.110	−0.650	−0.110	0.55	4
711 Marmulla	11.750	0.153			0.230	0.110)	11.70	0.15	11.69	0.15	11.90	0.15	−0.050	−0.060	0.150	0.07	12
712 Boliviana	8.330	0.032			0.030	0.010	8.60	0.15	8.48	0.03	8.32	0.03	0.270	0.150	−0.010	0.09	1
722 Frieda	12.310	0.076			0.230	0.110)	12.30	0.15	12.29	0.15	12.10	0.15	−0.010	−0.020	−0.210	0.04	12
726 Joella	10.570	0.042			0.090	0.090)	10.57	0.15	10.25	0.15	10.57	0.15	0.000	−0.320	0.000	0.12	3
728 Leonisis	13.000	0.067			0.230	0.110)	12.80	0.15	12.83	0.15	12.80	0.15	−0.200	−0.170	−0.200	0.13	12
739 Mandeville	8.760	0.058			0.090	0.090)	8.60	0.15	8.66	0.15	8.50	0.15	−0.160	−0.100	−0.260	0.14	1
746 Marlu	9.810	0.032			0.140	0.010	10.00	0.15	9.71	0.15	10.00	0.15	0.190	−0.100	0.190	0.23	3
770 Bali	11.110	0.036			0.160	0.020	10.90	0.15	10.89	0.15	11.11	0.15	−0.210	−0.220	0.000	0.55	12
776 Berbericia	7.632	0.031			0.140	0.010	7.68	0.34	7.79	0.34	7.68	0.34	0.048	0.158	0.048	0.21	3
779 Nina	8.100	0.036			0.260	0.040	8.30	0.15	7.87	0.15	8.30	0.15	0.200	−0.230	0.200	0.25	3
782 Montefiore	11.560	0.058			0.230	0.110)	11.50	0.15	11.23	0.15	11.58	0.15	−0.060	−0.330	0.020	0.43	12
795 Fini	9.780	0.066	9.400	0.042	0.120	0.080)	9.90	0.15	9.78	0.15	9.70	0.15	0.120	0.000	−0.080	0.02	10
822 Lalage	12.330	0.036			0.230	0.110)	12.18	0.15	12.01	0.15	12.18	0.15	−0.150	−0.320	−0.150	0.47	12
823 Sisigambis	11.370	0.058			0.230	0.110)	11.10	0.15	11.04	0.15	11.38	0.15	−0.270	−0.330	0.010	0.03	12
825 Tanina	11.840	0.067			0.230	0.110)	11.40	0.15	11.38	0.15	11.86	0.15	−0.440	−0.460	0.020	0.48	12
849 Ara	8.330	0.032			0.210	0.010	8.00	0.15	8.04	0.15	8.10	0.15	−0.330	−0.290	−0.230	0.34	3
851 Zeissia	11.600	0.036			0.230	0.110)	11.30	0.15	11.37	0.15	11.62	0.15	−0.300	−0.230	0.020	0.53	12
852 Wladilena	10.150	0.036			0.140	0.030	9.90	0.15	9.94	0.15	9.90	0.15	−0.250	−0.210	−0.250	0.30	4

(*continued on next page*)

Table 2 (*continued*)

Asteroid		H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{\mathrm{MPC}} - H$	$H_{\mathrm{AsD}} - H$	$H_{\mathrm{JPL}} - H$	Ampl.	Reference(s)
853	Nansenia	11.690	0.067			0.090	0.090)	11.50	0.15	11.38	0.15	11.69	0.15	−0.190	−0.310	0.000	0.11	12
870	Manto	11.680	0.042			0.230	0.110)	11.60	0.15	11.64	0.15	13.10	0.15	−0.080	−0.040	1.420	0.30	3
901	Brunsia	11.610	0.114			0.230	0.110)	11.50	0.15	11.46	0.15	11.35	0.15	−0.110	−0.150	−0.260	0.12	12
905	Universitas	11.660	0.050			0.090	0.090)	11.50	0.15	11.43	0.15	11.65	0.15	−0.160	−0.230	−0.010	0.23	12
920	Rogeria	11.285	0.100	10.830	0.095	0.240	0.110)	11.19	0.15	11.10	0.15	11.19	0.15	−0.095	−0.185	−0.095	0.16	10
925	Alphonsina	8.410	0.076			0.230	0.110)	8.40	0.15	8.25	0.15	8.33	0.15	−0.010	−0.160	−0.080	0.16	1
929	Algunde	11.860	0.116	11.370	0.104	0.240	0.110)	11.60	0.15	11.62	0.15	12.10	0.15	−0.260	−0.240	0.240	0.15	10
944	Hidalgo	10.480	0.058			−0.060	0.100	10.77	0.15	10.35	0.15	10.77	0.15	0.290	−0.130	0.290	0.48	12
945	Barcelona	10.140	0.032			0.230	0.110)	10.13	0.15	9.96	0.15	10.13	0.15	−0.010	−0.180	−0.010	0.09	1
968	Petunia	10.250	0.058			0.230	0.110)	10.10	0.15	10.11	0.15	10.26	0.15	−0.150	−0.140	0.010	0.07	12
980	Anacostia	7.855	0.030			0.060	0.003	7.85	0.06	7.75	0.06	7.85	0.06	−0.005	−0.105	−0.005	0.10	1
1025	Riema	12.920	0.050			0.420	0.080)	12.50	0.15	12.35	0.15	12.55	0.15	−0.420	−0.570	−0.370	0.06	12
1060	Magnolia	12.710	0.067			0.230	0.110)	12.70	0.15	12.60	0.15	12.70	0.15	−0.010	−0.110	−0.010	0.09	12
1065	Amundsenia	12.460	0.099	11.970	0.085	0.240	0.110)	12.00	0.15	11.95	0.15	13.20	0.15	−0.460	−0.510	0.740	0.15	10
1078	Mentha	11.900	0.202			0.230	0.110)	11.30	0.15	11.28	0.15	11.80	0.15	−0.600	−0.620	−0.100	0.87	12
1083	Salvia	12.250	0.114			0.230	0.110)	12.10	0.15	11.97	0.15	12.60	0.15	−0.150	−0.280	0.350	0.61	12
1088	Mitaka	11.620	0.085			0.230	0.110)	11.30	0.15	11.33	0.15	11.39	0.15	−0.320	−0.290	−0.230	0.40	12
1103	Sequoia	12.530	0.085			0.420	0.080)	12.10	0.15	12.04	0.15	12.25	0.15	−0.430	−0.490	−0.280	0.51	12
1117	Reginita	11.690	0.104			0.230	0.110)	11.70	0.15	11.75	0.15	11.90	0.15	0.010	0.060	0.210	0.13	12
1123	Shapleya	11.590	0.133			0.230	0.110)	11.60	0.15	11.57	0.15	11.70	0.15	0.010	−0.020	0.110	0.28	12
1126	Otero	12.098	0.077	11.570	0.058	0.240	0.110)	12.10	0.15	11.74	0.15	12.10	0.15	0.002	−0.358	0.002	0.69	10
1131	Porzia	13.100	0.143			0.230	0.110)	13.00	0.15	12.87	0.15	13.00	0.15	−0.100	−0.230	−0.100	0.23	12
1153	Wallenbergia	12.310	0.085			0.230	0.110)	12.00	0.15	11.99	0.15	12.10	0.15	−0.310	−0.320	−0.210	0.33	12
1177	Gonnessia	9.240	0.142	8.860	0.133	0.120	0.080)	9.30	0.15	9.10	0.15	9.30	0.15	0.060	−0.140	0.060	0.10	10
1204	Renzia	12.140	0.095			0.230	0.110)	12.20	0.15	11.91	0.15	12.20	0.15	0.060	−0.230	0.060	0.42	4
1235	Schorria	13.100	0.050			0.090	0.090)	12.68	0.15	12.91	0.15	12.68	0.15	−0.420	−0.190	−0.420	1.40	12
1270	Datura	12.610	0.124			0.230	0.110)	12.40	0.15	12.38	0.15	12.50	0.15	−0.210	−0.230	−0.110	0.41	12
1314	Paula	12.980	0.091	12.490	0.076	0.240	0.110)	12.68	0.15	12.73	0.15	12.68	0.15	−0.300	−0.250	−0.300	0.83	10
1338	Duponta	12.798	0.071	12.303	0.050	0.200	0.030	12.30	0.15	12.52	0.15	12.30	0.15	−0.498	−0.278	−0.498	0.26	9, 10
1367	Nongoma	12.300	0.104			0.230	0.110)	12.00	0.15	11.94	0.15	13.00	0.15	−0.300	−0.360	0.700	0.30	12
1374	Isora	13.670	0.153			0.230	0.110)	13.30	0.15	13.13	0.15	13.50	0.15	−0.370	−0.540	−0.170	0.20	12
1376	Michelle	12.810	0.050			0.230	0.110)	12.20	0.15	12.47	0.15	12.20	0.15	−0.610	−0.340	−0.610	0.19	12
1382	Gerti	12.510	0.032			0.230	0.110)	12.20	0.15	11.97	0.15	12.20	0.15	−0.310	−0.540	−0.310	0.29	12
1405	Sibelius	12.570	0.084	12.080	0.067	0.240	0.110)	12.50	0.15	12.48	0.15	12.30	0.15	−0.070	−0.090	−0.270	0.11	10
1419	Danzig	11.450	0.143			0.230	0.110)	11.20	0.15	11.25	0.15	11.30	0.15	−0.250	−0.200	−0.150	0.92	12
1429	Pemba	12.740	0.202			0.230	0.110)	12.20	0.15	12.18	0.15	12.50	0.15	−0.540	−0.560	−0.240	0.30	4
1453	Fennia	12.835	0.067			0.272	0.050	12.40	0.15	12.38	0.15	12.83	0.15	−0.435	−0.455	−0.005	0.15	9, 12
1472	Muonio	12.620	0.066	12.130	0.042	0.240	0.110)	12.70	0.15	12.22	0.15	12.70	0.15	0.080	−0.400	0.080	0.34	10
1509	Esclangona	12.858	0.152	12.330	0.143	0.240	0.110)	12.64	0.15	12.36	0.15	12.64	0.15	−0.218	−0.498	−0.218	0.13	10
1583	Antilochus	8.590	0.067			0.090	0.090)	8.50	0.15	8.52	0.15	8.58	0.15	−0.090	−0.070	−0.010	0.07	12
1593	Fagnes	13.381	0.042			0.149	0.110)	13.10	0.15	13.00	0.15	13.20	0.15	−0.281	−0.381	−0.181	0.41	3, 12
1613	Smiley	11.630	0.042			0.230	0.110)	11.40	0.15	11.55	0.15	11.63	0.15	−0.230	−0.080	0.000	0.20	12
1621	Druzhba	12.370	0.095			0.230	0.110)	11.70	0.15	11.70	0.15	12.39	0.15	−0.670	−0.670	0.020	0.16	12
1629	Pecker	12.360	0.107	11.870	0.095	0.240	0.110)	12.30	0.15	12.34	0.15	12.60	0.15	−0.060	−0.020	0.240	0.08	10
1640	Nemo	13.580	0.133			0.230	0.110)	13.10	0.15	13.00	0.15	13.10	0.15	−0.480	−0.580	−0.480	0.52	12
1644	Rafita	11.860	0.036			0.230	0.110)	11.82	0.15	11.35	0.15	11.82	0.15	−0.040	−0.510	−0.040	0.31	1
1656	Suomi	13.146	0.104			0.230	0.110)	12.40	0.15	12.67	0.15	13.16	0.15	−0.746	−0.476	0.014	0.10	12
1657	Roemera	12.890	0.163			0.230	0.110)	12.84	0.15	12.66	0.15	12.84	0.15	−0.050	−0.230	−0.050	0.09	12
1665	Gaby	11.900	0.202			0.230	0.110)	11.80	0.15	11.66	0.15	11.85	0.15	−0.100	−0.240	−0.050	0.27	3
1667	Pels	12.090	0.050			0.230	0.110)	11.90	0.15	11.92	0.15	12.10	0.15	−0.190	−0.170	0.010	0.25	12
1675	Simonida	11.900	0.067			0.230	0.110)	11.80	0.15	11.77	0.15	11.91	0.15	−0.100	−0.130	0.010	0.26	12
1689	Floris-Jan	11.740	0.058			0.230	0.110)	11.70	0.15	11.65	0.15	11.82	0.15	−0.040	−0.090	0.080	0.40	1
1717	Arlon	12.430	0.099	11.940	0.085	0.240	0.110)	12.30	0.15	12.19	0.15	12.90	0.15	−0.130	−0.240	0.470	0.08	10
1718	Namibia	13.800	0.133	13.310	0.124	0.050	0.120	13.80	0.15	13.68	0.15	13.50	0.15	0.000	−0.120	−0.300	0.16	10
1722	Goffin	12.180	0.104			0.150	0.200)	12.00	0.15	12.04	0.15	12.30	0.15	−0.180	−0.140	0.120	0.60	10
1736	Floirac	12.330	0.091	11.840	0.076	0.240	0.110)	12.20	0.15	12.21	0.15	12.20	0.15	−0.130	−0.120	−0.130	0.08	10
1777	Gehrels	11.773	0.042			0.343	0.040	11.60	0.15	11.43	0.15	11.10	0.15	−0.173	−0.343	−0.673	0.23	10, 12
1806	Derice	12.140	0.084	11.650	0.067	0.240	0.110)	12.00	0.15	12.01	0.15	12.00	0.15	−0.140	−0.130	−0.140	0.07	10
1830	Pogson	12.659	0.062	12.166	0.036	0.291	0.050	12.80	0.15	12.76	0.15	12.45	0.15	0.141	0.101	−0.209	0.11	9
1862	Apollo	16.384	0.063	15.930	0.058	0.240	0.110)	16.25	0.09	16.06	0.09	16.25	0.09	−0.134	−0.324	−0.134	0.21	10
1863	Antinous	15.639	0.066			0.119	0.020	15.54	0.15	15.33	0.15	15.54	0.15	−0.099	−0.309	−0.099	0.22	4, 10
1865	Cerberus	16.965	0.050			0.232	0.110)	16.84	0.15	16.54	0.15	16.84	0.15	−0.125	−0.425	−0.125	1.55	1, 12
1866	Sisyphus	12.510	0.152			0.235	0.110)	13.00	0.15	12.32	0.15	13.00	0.15	0.490	−0.190	0.490	0.08	10
1915	Quetzalcoatl	18.880	0.114			0.060	0.080	18.97	0.10	17.39	0.10	18.97	0.10	0.090	−1.490	0.090	0.20	1
1916	Boreas	14.860	0.116	14.370	0.104	0.120	0.050	14.93	0.15	14.62	0.15	14.93	0.15	0.070	−0.240	0.070	0.33	10
1943	Anteros	15.890	0.143			0.230	0.110	15.50	0.15	15.50	0.15	15.75	0.15	−0.390	−0.390	−0.140	0.07	6, 12
1951	Lick	14.350	0.202			0.180	0.100	14.70	0.15	13.89	0.15	14.51	0.15	0.350	−0.460	0.160	0.24	10, 12
1967	Menzel	12.250	0.066	11.760	0.042	0.240	0.110)	12.10	0.15	12.11	0.15	12.30	0.15	−0.150	−0.140	0.050	0.24	10
1979	Sakharov	13.800	0.062	13.310	0.036	0.340	0.030	13.60	0.15	13.49	0.15	13.50	0.15	−0.200	−0.310	−0.300	0.13	10
1980	Tezcatlipoca	13.960	0.104			0.230	0.110)	13.92	0.15	13.66	0.15	13.92	0.15	−0.040	−0.300	−0.040	0.72	12
1981	Midas	15.600	0.202			0.230	0.110)	15.20	0.15	15.10	0.15	15.50	0.15	−0.400	−0.500	−0.100	0.87	12
1991	Darwin	13.600	0.076			0.230	0.110)	13.40	0.15	13.34	0.15	12.90	0.15	−0.200	−0.260	−0.700	0.08	12
2002	Euler	12.700	0.107	12.210	0.095	0.240	0.110)	12.30	0.15	12.35	0.15	12.10	0.15	−0.400	−0.350	−0.600	0.31	10
2006	Polonskaya	13.350	0.077	12.970	0.058	0.420	0.060	12.90	0.15	12.90	0.15	12.60	0.15	−0.450	−0.450	−0.750	0.08	10
2049	Grietje	15.600	0.202			0.420	0.080)	14.80	0.15	14.70	0.15	14.90	0.15	−0.800	−0.900	−0.700	0.25	12
2063	Bacchus	17.250	0.202			0.230	0.100	17.10	0.15	17.12	0.15	17.10	0.15	−0.150	−0.130	−0.150	0.14	6

Table 2 (*continued*)

Asteroid	H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{MPC}-H$	$H_{AsD}-H$	$H_{JPL}-H$	Ampl.	Reference(s)
2094 Magnitka	12.490	0.208	12.000	0.202	0.400	0.200	11.90	0.15	12.08	0.15	12.00	0.15	−0.590	−0.410	−0.490	0.86	10
2100 Ra-Shalom	16.054	0.076			0.120	0.040	16.05	0.12	16.12	0.12	16.05	0.12	−0.004	0.066	−0.004	0.33	3, 6
2110 Moore-Sitterly	13.620	0.071	13.130	0.050	0.240	0.110)	13.30	0.15	13.15	0.15	13.80	0.15	−0.320	−0.470	0.180	0.37	10
2121 Sevastopol	12.480	0.091	11.990	0.076	0.290	0.060	12.10	0.15	12.27	0.15	12.30	0.15	−0.380	−0.210	−0.180	0.15	10
2212 Hephaistos	13.525	0.076			0.230	0.110)	13.20	0.15	13.16	0.15	13.87	0.15	−0.325	−0.365	0.345	0.08	12
2253 Espinette	13.130	0.124			0.230	0.110)	12.60	0.15	12.68	0.15	12.90	0.15	−0.530	−0.450	−0.230	0.48	12
2259 Sofievka	12.480	0.077	12.100	0.058	0.120	0.080)	12.40	0.15	12.49	0.15	12.60	0.15	−0.080	0.010	0.120	0.10	10
2382 Nonie	11.600	0.202			0.090	0.090)	11.40	0.15	11.65	0.15	11.40	0.15	−0.200	0.050	−0.200	0.05	12
2398 Jilin	13.540	0.099	13.050	0.085	0.240	0.110)	13.20	0.15	13.25	0.15	13.60	0.15	−0.340	−0.290	0.060	0.12	10
2478 Tokai	12.370	0.066	11.880	0.042	0.330	0.040	12.00	0.15	12.14	0.15	12.80	0.15	−0.370	−0.230	0.430	0.41	10
2486 Metsahovi	12.782	0.071	12.301	0.050	0.240	0.110)	12.40	0.15	12.43	0.15	12.40	0.15	−0.382	−0.352	−0.382	0.11	10
2501 Lohja	12.155	0.042			0.234	0.110)	11.80	0.15	11.94	0.15	12.08	0.15	−0.355	−0.215	−0.075	0.35	10, 12
2544 Gubarev	12.350	0.116	11.860	0.104	0.240	0.110)	11.90	0.15	11.83	0.15	12.30	0.15	−0.450	−0.520	−0.050	0.34	10
2577 Litva	13.480	0.095			0.420	0.080)	13.18	0.15	12.67	0.15	13.18	0.15	−0.300	−0.810	−0.300	0.36	12
2642 Vesale	12.450	0.104			0.230	0.110)	12.50	0.15	12.46	0.15	12.70	0.15	0.050	0.010	0.250	0.39	12
2659 Millis	11.650	0.036			0.090	0.090)	11.60	0.15	11.67	0.15	11.66	0.15	−0.050	0.020	0.010	0.53	12
2714 Matti	13.500	0.095			0.230	0.110)	12.70	0.15	12.72	0.15	13.40	0.15	−0.800	−0.780	−0.100	0.25	12
2754 Efimov	13.920	0.062	13.430	0.036	0.290	0.020	13.50	0.15	13.45	0.15	13.50	0.15	−0.420	−0.470	−0.420	0.16	10
2794 Kulik	13.480	0.133			0.230	0.110)	12.80	0.15	12.86	0.15	12.70	0.15	−0.680	−0.620	−0.780	0.22	12
2815 Soma	12.980	0.084	12.490	0.067	0.240	0.110)	12.60	0.15	12.64	0.15	13.20	0.15	−0.380	−0.340	0.220	0.08	10
2830 Greenwich	12.610	0.058			0.230	0.110)	12.30	0.15	12.24	0.15	12.64	0.15	−0.310	−0.370	0.030	0.05	1
2886 Tinkaping	13.280	0.104			0.230	0.110)	13.20	0.15	13.01	0.15	13.20	0.15	−0.080	−0.270	−0.080	0.13	12
2897 Ole Romer	13.640	0.124	13.150	0.114	0.240	0.110)	13.20	0.15	13.16	0.15	13.40	0.15	−0.440	−0.480	−0.240	0.14	10
2943 Heinrich	12.820	0.133	12.330	0.124	0.240	0.110)	12.80	0.15	12.51	0.15	12.80	0.15	−0.020	−0.310	−0.020	0.20	10
2954 Delsemme	13.580	0.095			0.230	0.110)	13.40	0.15	13.34	0.15	13.50	0.15	−0.180	−0.240	−0.080	0.21	12
3066 McFadden	11.240	0.085			0.230	0.110)	11.10	0.15	11.09	0.15	11.20	0.15	−0.140	−0.150	−0.040	0.04	12
3073 Kursk	13.860	0.116	13.370	0.104	0.240	0.110)	13.40	0.15	13.38	0.15	13.50	0.15	−0.460	−0.480	−0.360	0.21	10
3101 Goldberger	14.670	0.104			0.420	0.080)	13.80	0.15	13.76	0.15	14.20	0.15	−0.870	−0.910	−0.470	0.96	12
3102 Krok	16.524	0.153			0.317	0.110	16.10	0.15	15.89	0.15	15.60	0.15	−0.424	−0.634	−0.924	1.00	3, 10
3103 Eger	15.653	0.077	15.200	0.067	0.420	0.080	15.38	0.15	15.08	0.15	15.38	0.15	−0.273	−0.573	−0.273	0.60	10
3116 Goodricke	12.620	0.076			0.230	0.110)	12.40	0.15	12.39	0.15	12.50	0.15	−0.220	−0.230	−0.120	0.09	12
3121 Tamines	13.460	0.084	12.970	0.067	0.300	0.100	13.40	0.15	13.12	0.15	13.40	0.15	−0.060	−0.340	−0.060	0.04	10
3122 Florence	14.515	0.114			0.266	0.100	14.00	0.15	13.97	0.15	14.20	0.15	−0.515	−0.545	−0.315	0.17	10, 12
3200 Phaethon	14.345	0.071			0.164	0.030	14.60	0.15	14.17	0.15	14.51	0.15	0.255	−0.175	0.165	0.13	10, 12
3253 Gradie	13.590	0.067			0.230	0.110)	13.10	0.15	13.10	0.15	13.40	0.15	−0.490	−0.490	−0.190	0.54	12
3255 Tholen	13.840	0.050			0.230	0.110)	13.20	0.15	13.20	0.15	13.60	0.15	−0.640	−0.640	−0.240	0.08	12
3279 Solon	13.410	0.071	12.920	0.050	0.240	0.110)	13.30	0.15	12.99	0.15	13.30	0.15	−0.110	−0.420	−0.110	0.85	10
3287 Olmstead	14.370	0.104			0.230	0.110)	14.00	0.15	13.97	0.15	15.00	0.15	−0.370	−0.400	0.630	0.36	12
3309 Brorfelde	14.062	0.071			0.287	0.050	13.50	0.15	13.52	0.15	13.90	0.15	−0.562	−0.542	−0.162	0.14	9, 12
3352 McAuliffe	16.068	0.116	15.540	0.104	0.190	0.100	15.60	0.15	15.50	0.15	15.80	0.15	−0.468	−0.568	−0.268	0.20	10
3362 Khufu	18.390	0.143			0.230	0.110)	18.30	0.15	18.14	0.15	18.30	0.15	−0.090	−0.250	−0.090	0.14	12
3376 Armandhammer	12.540	0.071	12.050	0.050	0.240	0.110)	12.40	0.15	12.40	0.15	12.40	0.15	−0.140	−0.140	−0.140	0.04	10
3402 Wisdom	15.340	0.124	14.850	0.114	0.240	0.110)	14.90	0.15	14.88	0.15	15.20	0.15	−0.440	−0.460	−0.140	0.74	10
3507 Vilas	11.560	0.050			0.420	0.080)	11.30	0.15	11.37	0.15	11.30	0.15	−0.260	−0.190	−0.260	0.29	12
3553 Mera	16.650	0.142	16.160	0.133	0.240	0.110)	16.40	0.15	16.35	0.15	16.50	0.15	−0.250	−0.300	−0.150	0.08	10
3554 Amun	15.870	0.076			0.260	0.060	15.60	0.15	15.53	0.15	15.87	0.15	−0.270	−0.340	0.000	0.19	12
3576 Galina	13.200	0.116	12.710	0.104	0.240	0.110)	12.90	0.15	12.89	0.15	13.10	0.15	−0.300	−0.310	−0.100	0.05	10
3577 Putilin	10.600	0.104			0.090	0.090)	10.30	0.15	10.50	0.15	10.40	0.15	−0.300	−0.100	−0.200	0.10	12
3581 Alvarez	12.400	0.153			0.090	0.090)	12.10	0.15	12.11	0.15	12.10	0.15	−0.300	−0.290	−0.300	0.06	12
3638 Davis	11.640	0.042			0.090	0.090)	11.30	0.15	11.37	0.15	11.40	0.15	−0.340	−0.270	−0.240	0.40	12
3665 Fitzgerald	13.460	0.187	13.040	0.182	0.240	0.200)	12.90	0.15	12.81	0.15	12.60	0.15	−0.560	−0.650	−0.860	0.08	10
3671 Dionysus	16.670	0.085			0.210	0.030	16.50	0.15	16.33	0.15	16.30	0.15	−0.170	−0.340	−0.370	0.12	8
3673 Levy	13.140	0.084	12.650	0.067	0.280	0.080	12.80	0.15	12.78	0.15	13.00	0.15	−0.340	−0.360	−0.140	0.13	10
3691 Bede	15.220	0.104			0.430	0.080)	14.50	0.15	14.49	0.15	14.90	0.15	−0.720	−0.730	−0.320	0.50	10
3752 Camillo	15.410	0.133			0.230	0.110	15.50	0.15	15.14	0.15	15.50	0.15	0.090	−0.270	0.090	1.10	6
3757 1982 XB	19.120	0.067			0.240	0.040	18.95	0.15	19.13	0.15	18.95	0.15	−0.170	0.010	−0.170	0.14	4
3824 Brendalee	13.520	0.036			0.230	0.110)	13.20	0.15	13.24	0.15	13.20	0.15	−0.320	−0.280	−0.320	0.18	12
3825 Nurnberg	13.140	0.077	12.650	0.058	0.240	0.110)	12.70	0.15	12.70	0.15	13.00	0.15	−0.440	−0.440	−0.140	0.71	10
3838 Epona	15.850	0.062	15.360	0.036	0.050	0.010	15.50	0.15	15.45	0.15	15.50	0.15	−0.350	−0.400	−0.350	0.05	10
3868 Mendoza	12.710	0.050			0.220	0.030)	12.40	0.15	12.40	0.15	13.00	0.15	−0.310	−0.310	0.290	0.11	10
3888 Hoyt	13.260	0.133	12.770	0.124	0.240	0.110)	12.70	0.15	12.55	0.15	12.90	0.15	−0.560	−0.710	−0.360	0.70	10
3896 Pordenone	11.610	0.107	11.120	0.095	0.240	0.110)	11.30	0.15	11.37	0.15	11.30	0.15	−0.310	−0.240	−0.310	0.25	10
3913 Chemin	13.290	0.152	12.800	0.143	0.240	0.110)	12.70	0.15	12.60	0.15	12.20	0.15	−0.590	−0.690	−1.090	0.45	10
3918 Brel	13.030	0.071	12.540	0.050	0.240	0.110)	12.50	0.15	12.57	0.15	13.30	0.15	−0.530	−0.460	0.270	0.25	10
3928 Randa	13.650	0.208	13.160	0.202	0.240	0.110)	13.30	0.15	13.17	0.15	13.30	0.15	−0.350	−0.480	−0.350	0.55	10
3953 Perth	14.060	0.050			0.230	0.110)	13.60	0.15	13.45	0.15	13.60	0.15	−0.460	−0.610	−0.460	1.09	12
3982 Kastel'	13.350	0.085			0.510	0.130	13.20	0.15	12.80	0.15	13.20	0.15	−0.150	−0.550	−0.150	0.27	10
4029 Bridges	12.960	0.099	12.470	0.085	0.240	0.110)	12.80	0.15	12.63	0.15	12.90	0.15	−0.160	−0.330	−0.060	0.21	10
4082 Swann	13.460	0.208	13.080	0.202	0.030	0.150	12.90	0.15	13.28	0.15	12.90	0.15	−0.560	−0.180	−0.560	0.67	10
4179 Toutatis	15.300	0.163			0.100	0.100)	15.30	0.10	15.21	0.10	15.30	0.10	0.000	−0.090	0.000	0.07	12
4197 1982 TA	14.800	0.202			0.010	0.050	14.60	0.15	14.83	0.15	14.60	0.15	−0.200	0.030	−0.200	0.28	12
4263 Abashiri	12.930	0.099	12.440	0.085	0.240	0.110)	12.60	0.15	12.62	0.15	12.60	0.15	−0.330	−0.310	−0.330	0.15	10
4285 Hulkower	12.960	0.091	12.470	0.076	0.240	0.110)	12.40	0.15	12.33	0.15	12.10	0.15	−0.560	−0.630	−0.860	0.58	10
4323 Hortulus	13.570	0.099	13.080	0.085	0.240	0.110)	13.60	0.15	13.34	0.15	13.60	0.15	0.030	−0.230	0.030	0.23	10
4335 Verona	13.650	0.116	13.160	0.104	0.240	0.110)	13.30	0.15	13.25	0.15	13.60	0.15	−0.350	−0.400	−0.050	0.40	10

(*continued on next page*)

Table 2 (*continued*)

Asteroid	H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{\mathrm{MPC}} - H$	$H_{\mathrm{AsD}} - H$	$H_{\mathrm{JPL}} - H$	Ampl.	Reference(s)
4435 Holt	13.320	0.114			0.230	0.110)	13.20	0.15	13.01	0.15	13.20	0.15	−0.120	−0.310	−0.120	0.00	12
4483 Petofi	13.570	0.067			0.420	0.080)	13.00	0.15	13.00	0.15	11.90	0.15	−0.570	−0.570	−1.670	0.98	12
4503 Cleobulus	16.020	0.114			0.230	0.110)	15.60	0.15	15.55	0.15	15.60	0.15	−0.420	−0.470	−0.420	0.22	12
4533 Orth	13.140	0.099	12.650	0.085	0.370	0.100	12.80	0.15	12.63	0.15	12.80	0.15	−0.340	−0.510	−0.340	0.10	10
4555 1987 QL	14.280	0.116	13.790	0.104	0.300	0.100	13.70	0.15	13.73	0.15	13.70	0.15	−0.580	−0.550	−0.580	0.22	10
4558 Janesick	12.770	0.182			0.230	0.110)	12.50	0.15	12.50	0.15	12.20	0.15	−0.270	−0.270	−0.570	0.11	12
4587 Rees	15.870	0.077	15.380	0.058	0.370	0.050	15.60	0.15	15.00	0.15	15.60	0.15	−0.270	−0.870	−0.270	0.78	10
4638 Estens	13.950	0.077	13.460	0.058	0.240	0.110)	14.00	0.15	13.52	0.15	14.00	0.15	0.050	−0.430	0.050	0.16	10
4666 Dietz	13.160	0.107	12.670	0.095	0.240	0.110)	12.70	0.15	12.62	0.15	13.00	0.15	−0.460	−0.540	−0.160	0.24	10
4674 Pauling	14.245	0.118	13.790	0.095	0.330	0.100)	13.30	0.15	13.63	0.15	13.30	0.15	−0.945	−0.615	−0.945	0.06	10
4786 Tatianina	13.718	0.105	13.310	0.104	0.460	0.100	13.20	0.15	13.15	0.15	13.20	0.15	−0.518	−0.568	−0.518	0.19	10
4951 Iwamoto	13.740	0.067			0.190	0.050	13.20	0.15	13.19	0.15	13.40	0.15	−0.540	−0.550	−0.340	0.34	11
5080 Oja	13.010	0.071	12.520	0.050	0.240	0.110)	12.60	0.15	12.58	0.15	12.90	0.15	−0.410	−0.430	−0.110	0.39	10
5129 Groom	13.060	0.107	12.570	0.095	0.160	0.090	12.60	0.15	12.52	0.15	12.40	0.15	−0.460	−0.540	−0.660	0.21	10
5143 Heracles	14.270	0.095			0.420	0.080	13.80	0.15	13.74	0.15	14.00	0.15	−0.470	−0.530	−0.270	0.10	6
5313 Nunes	13.780	0.084	13.290	0.067	0.240	0.110)	13.30	0.15	13.36	0.15	12.90	0.15	−0.480	−0.420	−0.880	0.17	10
5332 Davidaguilar	14.890	0.133			0.230	0.110)	14.60	0.15	14.52	0.15	13.90	0.15	−0.290	−0.370	−0.990	0.35	12
5342 Le Poole	14.120	0.099	13.630	0.085	0.240	0.110)	13.50	0.15	13.49	0.15	13.90	0.15	−0.620	−0.630	−0.220	0.45	10
5407 1992 AX	14.470	0.058			0.320	0.070	13.70	0.15	13.69	0.15	13.90	0.15	−0.770	−0.780	−0.570	0.10	8
5440 Terao	13.770	0.091	13.280	0.076	0.240	0.110)	13.30	0.15	13.29	0.15	13.30	0.15	−0.470	−0.480	−0.470	1.00	10
5451 Plato	14.580	0.124	14.090	0.114	0.240	0.110)	14.10	0.15	13.99	0.15	14.20	0.15	−0.480	−0.590	−0.380	0.61	10
5474 Gingasen	13.280	0.116	12.790	0.104	0.240	0.110)	12.90	0.15	12.85	0.15	12.60	0.15	−0.380	−0.430	−0.680	0.18	10
5477 Holmes	14.445	0.082	13.990	0.042	0.390	0.030	13.40	0.15	13.77	0.15	13.40	0.15	−1.045	−0.675	−1.045	0.10	9
5481 Kiuchi	13.676	0.069	13.160	0.058	0.430	0.080	13.10	0.15	13.11	0.15	13.00	0.15	−0.576	−0.566	−0.676	0.09	10
5484 Inoda	13.170	0.099	12.680	0.085	0.240	0.110)	12.70	0.15	12.73	0.15	12.60	0.15	−0.470	−0.440	−0.570	0.16	10
5580 Sharidake	14.120	0.071	13.630	0.050	0.240	0.110)	13.70	0.15	13.71	0.15	13.20	0.15	−0.420	−0.410	−0.920	0.37	10
5645 1990 SP	17.240	0.208	16.750	0.202	0.000	0.100	16.80	0.15	16.64	0.15	17.00	0.15	−0.440	−0.600	−0.240	0.72	10
5653 Camarillo	16.420	0.133	15.930	0.124	0.240	0.110)	16.10	0.15	16.04	0.15	15.40	0.15	−0.320	−0.380	−1.020	0.40	10
5693 1993 EA	16.870	0.076			0.230	0.110)	17.00	0.15	16.50	0.15	17.00	0.15	0.130	−0.370	0.130	0.11	12
5736 Sanford	14.170	0.180	13.680	0.173	0.240	0.110)	13.60	0.15	13.57	0.15	13.40	0.15	−0.570	−0.600	−0.770	0.42	10
5751 Zao	14.940	0.182			0.230	0.110)	14.60	0.15	14.50	0.15	14.80	0.15	−0.340	−0.440	−0.140	0.04	12
5783 Kumagaya	13.810	0.071	13.320	0.050	0.240	0.110)	13.30	0.15	13.27	0.15	13.10	0.15	−0.510	−0.540	−0.710	0.22	10
5786 Talos	17.360	0.142	16.870	0.133	0.240	0.110)	17.10	0.15	16.97	0.15	17.00	0.15	−0.260	−0.390	−0.360	0.23	10
5797 Bivoj	18.940	0.036			0.230	0.110)	18.70	0.15	18.64	0.15	19.10	0.15	−0.240	−0.300	0.160	0.12	1
5836 1993 MF	15.141	0.142			0.236	0.110)	14.60	0.15	14.46	0.15	13.90	0.15	−0.541	−0.681	−1.241	0.65	10, 12
5905 Johnson	14.255	0.134	13.800	0.114	0.330	0.100)	14.00	0.15	13.84	0.15	13.20	0.15	−0.255	−0.415	−1.055	0.09	10
5985 1942 RJ	13.530	0.091	13.040	0.076	0.240	0.110)	13.10	0.15	13.23	0.15	13.10	0.15	−0.430	−0.300	−0.430	0.14	10
5999 Plescia	14.800	0.161	14.310	0.153	0.240	0.110)	14.30	0.15	14.23	0.15	14.30	0.15	−0.500	−0.570	−0.500	0.69	10
6070 Rheinland	14.170	0.062	13.680	0.036	0.310	0.030	13.60	0.15	13.68	0.15	13.60	0.15	−0.570	−0.490	−0.570	0.40	10
6084 Bascom	13.290	0.066	12.800	0.042	0.260	0.050	12.70	0.15	12.68	0.15	12.80	0.15	−0.590	−0.610	−0.490	0.22	10
6178 1986 DA	15.900	0.116	15.410	0.104	0.200	0.070)	15.10	0.15	15.36	0.15	15.10	0.15	−0.800	−0.540	−0.800	0.30	10
6179 Brett	14.160	0.142	13.670	0.133	0.240	0.110)	13.40	0.15	13.32	0.15	13.70	0.15	−0.760	−0.840	−0.460	0.70	10
6185 1987 YD	13.480	0.091	12.990	0.076	0.240	0.110)	13.20	0.15	12.99	0.15	13.20	0.15	−0.280	−0.490	−0.280	0.33	10
6239 Minos	18.740	0.099	18.250	0.085	0.240	0.050	18.20	0.15	18.30	0.15	17.90	0.15	−0.540	−0.440	−0.840	0.08	10
6244 Okamoto	13.900	0.071	13.410	0.050	0.280	0.040	13.60	0.15	13.44	0.15	13.60	0.15	−0.300	−0.460	−0.300	0.11	10
6361 1978 VL11	13.860	0.077	13.370	0.058	0.240	0.110)	13.10	0.15	13.12	0.15	12.20	0.15	−0.760	−0.740	−1.660	0.67	10
6405 Komiyama	13.430	0.116	12.940	0.104	0.240	0.110)	13.10	0.15	13.00	0.15	13.20	0.15	−0.330	−0.430	−0.230	0.13	10
6453 1991 NY	13.810	0.116	13.320	0.104	0.240	0.110)	13.60	0.15	13.56	0.15	13.60	0.15	−0.210	−0.250	−0.210	0.20	10
6455 1992 HE	14.215	0.116	13.725	0.104	0.340	0.100	13.90	0.15	13.71	0.15	13.80	0.15	−0.315	−0.505	−0.415	0.10	10
6456 Golombek	16.030	0.107	15.540	0.095	0.120	0.080)	15.80	0.15	15.75	0.15	15.90	0.15	−0.230	−0.280	−0.130	0.13	10
6611 1993 VW	17.256	0.102	16.740	0.095	0.430	0.080)	16.70	0.15	16.65	0.15	16.50	0.15	−0.556	−0.606	−0.756	0.06	10
6708 Bobbievaile	13.290	0.071	12.800	0.050	0.240	0.040	12.90	0.15	12.93	0.15	12.80	0.15	−0.390	−0.360	−0.490	0.09	10
6815 Mutchler	14.990	0.066	14.500	0.042	0.240	0.110)	14.50	0.15	14.49	0.15	14.20	0.15	−0.490	−0.500	−0.790	0.09	10
6949 Zissell	14.000	0.124	13.510	0.114	0.240	0.110)	13.50	0.15	13.42	0.15	13.10	0.15	−0.500	−0.580	−0.900	0.24	10
7020 Yourcenar	14.290	0.116	13.800	0.104	0.240	0.110)	13.70	0.15	13.89	0.15	13.70	0.15	−0.590	−0.400	−0.590	0.37	10
7030 Colombini	14.480	0.099	13.990	0.085	0.240	0.110)	13.90	0.15	13.62	0.15	13.90	0.15	−0.580	−0.860	−0.580	0.47	10
7033 1994 WN2	14.000	0.116	13.510	0.104	0.240	0.110)	13.60	0.15	13.55	0.15	13.30	0.15	−0.400	−0.450	−0.700	0.10	10
7043 Godart	13.490	0.084	13.000	0.067	0.330	0.150	13.00	0.15	13.05	0.15	12.80	0.15	−0.490	−0.440	−0.690	0.68	10
7088 Ishtar	17.080	0.142	16.590	0.133	0.240	0.110)	16.70	0.15	16.57	0.15	16.70	0.15	−0.380	−0.510	−0.380	0.11	10
7089 1992 FX1	14.050	0.091	13.560	0.076	0.240	0.110)	13.50	0.15	13.41	0.15	13.70	0.15	−0.550	−0.640	−0.350	0.06	10
7116 Mentall	13.540	0.084	13.050	0.067	0.240	0.110)	13.10	0.15	13.12	0.15	13.50	0.15	−0.440	−0.420	−0.040	0.11	10
7225 Huntress	13.490	0.066	13.000	0.042	0.360	0.100	13.00	0.15	12.99	0.15	13.30	0.15	−0.490	−0.500	−0.190	0.11	10
7229 Tonimoore	15.600	0.202			0.230	0.110)	15.30	0.15	15.03	0.15	15.60	0.15	−0.300	−0.570	0.000	0.37	12
7267 Victormeen	13.930	0.142	13.440	0.133	0.240	0.110)	13.60	0.15	13.57	0.15	13.50	0.15	−0.330	−0.360	−0.430	0.20	10
7336 Saunders	19.020	0.116	18.530	0.104	0.240	0.110)	18.80	0.15	18.75	0.15	18.70	0.15	−0.220	−0.270	−0.320	0.20	10
7341 1991 VK	16.950	0.202			0.260	0.140	16.70	0.15	16.66	0.15	16.70	0.15	−0.250	−0.290	−0.250	0.49	6
7369 Gavrilin	13.610	0.161	13.120	0.153	0.200	0.150)	13.10	0.15	13.06	0.15	12.90	0.15	−0.510	−0.550	−0.710	0.25	10
7480 Norwan	17.450	0.163			0.230	0.110	17.00	0.15	16.89	0.15	17.20	0.15	−0.450	−0.560	−0.250	0.50	6
7481 San Marcello	12.540	0.116	12.160	0.104	0.120	0.080)	12.30	0.15	12.33	0.15	11.80	0.15	−0.240	−0.210	−0.740	0.08	10
7735 Scorzelli	13.100	0.208	12.720	0.202	0.120	0.080)	12.30	0.15	12.86	0.15	12.30	0.15	−0.800	−0.240	−0.800	0.84	10
7977 1977 QQ5	15.600	0.142	15.110	0.133	0.240	0.110)	15.40	0.15	15.02	0.15	15.40	0.15	−0.200	−0.580	−0.200	0.57	10
8013 Gordonmoore	17.260	0.152			0.235	0.110)	16.60	0.15	16.67	0.15	16.60	0.15	−0.660	−0.590	−0.660	0.20	10, 12
8033 1992 FY1	13.640	0.077	13.150	0.058	0.240	0.110)	13.20	0.15	13.16	0.15	13.40	0.15	−0.440	−0.480	−0.240	0.14	10
8034 Akka	18.148	0.114			0.230	0.110	17.90	0.15	17.79	0.15	17.90	0.15	−0.248	−0.358	−0.248	0.47	6, 12
8037 1993 HO1	16.710	0.071	16.220	0.050	0.240	0.110)	16.20	0.15	16.20	0.15	16.60	0.15	−0.510	−0.510	−0.110	0.10	10

Table 2 (*continued*)

Asteroid		H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{\mathrm{MPC}}-H$	$H_{\mathrm{AsD}}-H$	$H_{\mathrm{JPL}}-H$	Ampl.	Reference(s)
8116	Jeanperrin	14.050	0.058			0.230	0.060	13.60	0.15	13.61	0.15	13.80	0.15	−0.450	−0.440	−0.250	0.09	10
8195	1993 UC1	12.900	0.099	12.410	0.085	0.240	0.110)	12.70	0.15	12.47	0.15	12.70	0.15	−0.200	−0.430	−0.200	0.33	10
8338	Ralhan	14.020	0.091	13.530	0.076	0.240	0.110)	13.50	0.15	13.47	0.15	13.40	0.15	−0.520	−0.550	−0.620	0.44	10
8356	Wadhwa	13.070	0.142	12.580	0.133	0.240	0.110)	12.80	0.15	12.81	0.15	12.80	0.15	−0.270	−0.260	−0.270	0.12	10
8567	1996 HW1	15.270	0.152	14.780	0.143	0.240	0.110)	15.30	0.15	15.30	0.15	15.30	0.15	0.030	0.030	0.030	0.25	10
8663	1991 DJ1	14.100	0.091	13.610	0.076	0.240	0.110)	13.70	0.15	13.59	0.15	14.00	0.15	−0.400	−0.510	−0.100	0.30	10
9260	Edwardolson	14.540	0.091	14.050	0.076	0.240	0.110)	14.00	0.15	13.94	0.15	14.70	0.15	−0.540	−0.600	0.160	0.11	10
9556	Gaywray	13.710	0.208	13.220	0.202	0.240	0.110)	13.10	0.15	13.10	0.15	13.40	0.15	−0.610	−0.610	−0.310	0.50	10
9617	Grahamchapman	14.970	0.084	14.480	0.067	0.240	0.110)	14.60	0.15	14.46	0.15	14.10	0.15	−0.370	−0.510	−0.870	0.10	10
9782	Edo	13.480	0.107	12.990	0.095	0.240	0.110)	13.10	0.15	13.01	0.15	13.40	0.15	−0.380	−0.470	−0.080	0.67	10
9948	1990 QB2	14.620	0.066	14.130	0.042	0.240	0.110)	14.50	0.15	14.13	0.15	14.50	0.15	−0.120	−0.490	−0.120	0.74	10
9992	1997 TG19	14.970	0.099	14.480	0.085	0.240	0.110)	14.40	0.15	14.38	0.15	14.40	0.15	−0.570	−0.590	−0.570	0.42	10
10123	Fideoja	14.530	0.084	14.040	0.067	0.240	0.110)	14.20	0.15	14.06	0.15	13.80	0.15	−0.330	−0.470	−0.730	0.00	10
10188	Yasuoyoneda	14.030	0.124	13.540	0.114	0.240	0.110)	13.60	0.15	13.56	0.15	14.20	0.15	−0.430	−0.470	0.170	0.12	10
10208	Germanicus	14.790	0.142	14.300	0.133	0.240	0.110)	14.30	0.15	14.32	0.15	14.60	0.15	−0.490	−0.470	−0.190	0.13	10
10484	Hecht	14.180	0.107	13.690	0.095	0.240	0.110)	13.80	0.15	13.72	0.15	13.90	0.15	−0.380	−0.460	−0.280	0.20	10
10548	1992 PJ2	14.750	0.142	14.260	0.133	0.240	0.110)	14.50	0.15	14.34	0.15	14.50	0.15	−0.250	−0.410	−0.250	0.34	10
11072	Hiraoka	13.720	0.099	13.230	0.085	0.240	0.110)	13.30	0.15	13.16	0.15	13.50	0.15	−0.420	−0.560	−0.220	0.26	10
11271	1988 KB	13.170	0.142	12.680	0.133	0.240	0.110)	12.80	0.15	12.77	0.15	13.60	0.15	−0.370	−0.400	0.430	0.35	10
11398	1998 YP11	16.590	0.066	16.100	0.042	0.290	0.020	16.40	0.15	16.38	0.15	16.30	0.15	−0.190	−0.210	−0.290	0.25	10
11500	Tomaiyowit	18.490	0.116	18.000	0.104	0.190	0.050	18.40	0.15	18.27	0.15	18.40	0.15	−0.090	−0.220	−0.090	0.50	10
11756	Geneparker	15.020	0.084	14.530	0.067	0.240	0.110)	14.60	0.15	14.58	0.15	15.10	0.15	−0.420	−0.440	0.080	0.14	10
12466	1997 AS12	14.210	0.099	13.720	0.085	0.240	0.110)	13.80	0.15	13.70	0.15	13.70	0.15	−0.410	−0.510	−0.510	0.06	10
12711	Tukmit	16.240	0.084	15.750	0.067	0.250	0.050	15.80	0.15	15.69	0.15	16.00	0.15	−0.440	−0.550	−0.240	0.70	10
12923	Zephyr	15.930	0.084	15.440	0.067	0.240	0.110)	15.70	0.15	15.68	0.15	16.10	0.15	−0.230	−0.250	0.170	0.18	10
13144	1995 BJ	13.400	0.116	13.020	0.104	0.120	0.080)	13.10	0.15	13.15	0.15	13.30	0.15	−0.300	−0.250	−0.100	0.19	10
13154	Petermrva	14.600	0.066	14.110	0.042	0.200	0.100	14.10	0.15	14.07	0.15	14.20	0.15	−0.500	−0.530	−0.400	0.14	10
13166	1995 WU1	12.950	0.099	12.460	0.085	0.240	0.110)	12.30	0.15	12.45	0.15	12.30	0.15	−0.650	−0.500	−0.650	0.22	10
13553	1992 JE	16.710	0.133	16.220	0.124	0.240	0.110)	16.00	0.15	16.29	0.15	16.00	0.15	−0.710	−0.420	−0.710	1.10	10
13651	1997 BR	18.050	0.153			0.080	0.090	17.60	0.15	17.56	0.15	17.60	0.15	−0.450	−0.490	−0.450	1.20	6
14211	1999 NT1	14.220	0.152	13.730	0.143	0.240	0.110)	13.70	0.15	13.68	0.15	13.70	0.15	−0.520	−0.540	−0.520	0.12	10
14402	1991 DB	19.040	0.062	18.550	0.036	0.260	0.030	18.40	0.15	18.53	0.15	18.40	0.15	−0.640	−0.510	−0.640	0.11	10
15350	Naganuma	14.160	0.107	13.670	0.095	0.240	0.110)	13.90	0.15	13.94	0.15	13.90	0.15	−0.260	−0.220	−0.260	0.07	10
15533	2000 AP138	14.180	0.107	13.690	0.095	0.240	0.110)	13.60	0.15	13.59	0.15	13.60	0.15	−0.580	−0.590	−0.580	0.38	10
15700	1987 QD	14.990	0.091	14.500	0.076	0.240	0.110)	14.40	0.15	14.43	0.15	14.40	0.15	−0.590	−0.560	−0.590	0.07	10
15702	Olegkotov	13.210	0.071	12.830	0.050	0.120	0.080)	12.90	0.15	12.91	0.15	13.50	0.15	−0.310	−0.300	0.290	0.05	10
15793	1993 TG19	15.460	0.208	14.970	0.202	0.240	0.110)	14.70	0.15	14.73	0.15	15.10	0.15	−0.760	−0.730	−0.360	0.71	10
16064	1999 RH27	16.560	0.071	16.070	0.050	−0.140	0.020	16.80	0.15	16.66	0.15	16.90	0.15	0.240	0.100	0.340	0.70	10
16115	1999 XH25	13.280	0.099	12.900	0.085	0.120	0.080)	13.00	0.15	12.97	0.15	13.30	0.15	−0.280	−0.310	0.020	0.26	10
16173	2000 AC98	14.430	0.066	13.940	0.042	0.270	0.050	14.00	0.15	13.90	0.15	13.80	0.15	−0.430	−0.530	−0.630	0.36	10
16403	1984 WJ1	13.740	0.071	13.250	0.050	0.370	0.050	12.70	0.15	13.30	0.15	12.70	0.15	−1.040	−0.440	−1.040	0.14	10
16691	1994 VS	15.010	0.208	14.520	0.202	0.240	0.110)	14.50	0.15	14.40	0.15	15.00	0.15	−0.510	−0.610	−0.010	0.25	10
17060	Mikecombi	14.020	0.133	13.530	0.124	0.240	0.110)	13.40	0.15	13.38	0.15	13.60	0.15	−0.620	−0.640	−0.420	0.33	10
17260	2000 JQ58	14.580	0.116	14.090	0.104	0.160	0.120	14.20	0.15	14.16	0.15	14.00	0.15	−0.380	−0.420	−0.580	0.15	9
17470	1991 BX	13.280	0.116	12.900	0.104	0.120	0.080)	13.10	0.15	12.99	0.15	12.60	0.15	−0.180	−0.290	−0.680	0.68	10
17479	1991 PV9	13.640	0.077	13.150	0.058	0.240	0.110)	13.20	0.15	13.13	0.15	13.20	0.15	−0.440	−0.510	−0.440	0.31	10
17938	Tamsendrew	14.870	0.124	14.380	0.114	0.240	0.110)	14.40	0.15	14.38	0.15	14.80	0.15	−0.470	−0.490	−0.070	0.17	10
18096	2000 LM16	13.960	0.208	13.470	0.202	0.120	0.080)	13.70	0.15	13.58	0.15	13.80	0.15	−0.260	−0.380	−0.160	0.18	10
18109	2000 NG11	17.180	0.208	16.690	0.202	0.040	0.100	17.50	0.15	16.91	0.15	17.50	0.15	0.320	−0.270	0.320	1.13	10
18503	1996 PY4	14.510	0.161	14.020	0.153	0.240	0.110)	13.90	0.15	13.85	0.15	14.80	0.15	−0.610	−0.660	0.290	0.25	10
19763	Klimesh	13.270	0.133	12.780	0.124	0.240	0.110)	12.80	0.15	12.72	0.15	13.20	0.15	−0.470	−0.550	−0.070	0.67	10
19764	2000 NF5	16.280	0.084	15.790	0.067	0.300	0.100	15.90	0.15	15.81	0.15	16.00	0.15	−0.380	−0.470	−0.280	0.80	10
20031	1992 OO	13.850	0.124	13.360	0.114	0.240	0.110)	13.20	0.15	13.12	0.15	12.90	0.15	−0.650	−0.730	−0.950	0.39	10
20236	1998 BZ7	17.930	0.152	17.440	0.143	0.240	0.110)	17.60	0.15	17.56	0.15	17.60	0.15	−0.330	−0.370	−0.330	0.17	10
20255	1998 FX2	18.370	0.114			0.240	0.110)	18.20	0.15	18.27	0.15	18.20	0.15	−0.170	−0.100	−0.170	0.17	10
20429	1998 YN1	17.980	0.124	17.490	0.114	0.240	0.110)	17.60	0.15	17.29	0.15	18.00	0.15	−0.380	−0.690	0.020	0.15	10
20691	1999 VY72	13.690	0.116	13.200	0.104	0.240	0.110)	13.20	0.15	13.15	0.15	13.20	0.15	−0.490	−0.540	−0.490	0.13	10
20932	2258 T-1	13.780	0.084	13.290	0.067	0.240	0.110)	13.30	0.15	13.24	0.15	13.20	0.15	−0.480	−0.540	−0.580	0.17	10
21028	1989 TO	13.290	0.161	12.800	0.153	0.240	0.110)	13.60	0.15	13.07	0.15	13.60	0.15	0.310	−0.220	0.310	0.12	10
21088	1992 BL2	14.350	0.152	13.860	0.143	0.240	0.110)	14.20	0.15	14.14	0.15	14.40	0.15	−0.150	−0.210	0.050	0.13	10
21720	Pilishvili	15.140	0.077	14.650	0.058	0.240	0.110)	14.70	0.15	14.69	0.15	15.30	0.15	−0.440	−0.450	0.160	0.14	10
22166	2000 WX154	15.020	0.107	14.530	0.095	0.240	0.110)	14.40	0.15	14.13	0.15	14.60	0.15	−0.620	−0.890	−0.420	0.46	10
23809	Haswell	14.970	0.071	14.480	0.050	0.240	0.110)	14.40	0.15	14.32	0.15	15.00	0.15	−0.570	−0.650	0.030	0.16	10
23971	1998 YU9	14.570	0.091	14.080	0.076	0.120	0.080)	13.70	0.15	13.53	0.15	13.60	0.15	−0.870	−1.040	−0.970	0.79	10
23979	1999 JL82	13.900	0.084	13.410	0.067	0.240	0.110)	13.50	0.15	13.27	0.15	13.50	0.15	−0.400	−0.630	−0.400	0.17	10
24114	1999 VV23	13.520	0.133	13.030	0.124	0.240	0.110)	13.10	0.15	13.21	0.15	13.10	0.15	−0.420	−0.310	−0.420	0.26	10
24891	1997 AT2	15.690	0.077	15.200	0.058	0.240	0.110)	15.20	0.15	15.14	0.15	15.00	0.15	−0.490	−0.550	−0.690	0.96	10
25330	1999 KV4	16.730	0.149	16.310	0.143	0.120	0.080)	16.60	0.15	16.48	0.15	16.80	0.15	−0.130	−0.250	0.070	0.15	10
25355	1999 RU221	15.590	0.107	15.100	0.095	0.240	0.110)	14.80	0.15	14.88	0.15	15.20	0.15	−0.790	−0.710	−0.390	0.79	10
25458	1999 XT13	14.770	0.116	14.280	0.104	0.240	0.110)	14.20	0.15	14.19	0.15	13.90	0.15	−0.570	−0.580	−0.870	0.30	10
25719	2000 AV171	14.190	0.116	13.810	0.104	0.120	0.080)	13.60	0.15	13.62	0.15	13.80	0.15	−0.590	−0.570	−0.390	0.82	10
26045	1582 T-2	15.840	0.116	15.350	0.104	0.240	0.110)	15.50	0.15	15.44	0.15	15.80	0.15	−0.340	−0.400	−0.040	0.10	10
26760	2001 KP41	15.580	0.116	15.090	0.104	0.050	0.050	15.30	0.15	15.27	0.15	15.50	0.15	−0.280	−0.310	−0.080	0.31	10
26879	Haines	14.580	0.107	14.090	0.095	0.240	0.110)	14.20	0.15	13.99	0.15	14.40	0.15	−0.380	−0.590	−0.180	0.07	10
27695	1981 EW36	15.150	0.084	14.770	0.067	0.120	0.080)	15.00	0.15	14.86	0.15	15.10	0.15	−0.150	−0.290	−0.050	0.15	10

(*continued on next page*)

Table 2 (*continued*)

Asteroid	H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{\mathrm{MPC}} - H$	$H_{\mathrm{AsD}} - H$	$H_{\mathrm{JPL}} - H$	Ampl.	Reference(s)
28017 1997 YV13	13.910	0.099	13.420	0.085	0.240	0.110)	13.20	0.15	13.46	0.15	13.20	0.15	−0.710	−0.450	−0.710	0.15	10
29168 1990 kJ	13.840	0.133	13.350	0.124	0.240	0.110)	13.30	0.15	13.27	0.15	13.40	0.15	−0.540	−0.570	−0.440	0.14	10
29292 Conniewalker	13.590	0.116	13.100	0.104	0.240	0.110)	13.40	0.15	13.34	0.15	13.40	0.15	−0.190	−0.250	−0.190	0.63	10
30825 1990 TG1	14.920	0.142	14.430	0.133	0.240	0.110)	14.80	0.15	14.64	0.15	14.70	0.15	−0.120	−0.280	−0.220	0.11	10
31345 1998 PG	17.640	0.143			0.230	0.110	17.30	0.15	17.12	0.15	17.30	0.15	−0.340	−0.520	−0.340	0.11	7
31650 Frydek-Mistek	14.230	0.116	13.850	0.104	0.120	0.080)	13.80	0.15	13.78	0.15	13.90	0.15	−0.430	−0.450	−0.330	0.19	10
32008 2000 HM53	14.730	0.107	14.240	0.095	0.240	0.110)	14.30	0.15	14.25	0.15	14.10	0.15	−0.430	−0.480	−0.630	0.19	10
32039 2000 JO23	14.870	0.066	14.380	0.042	0.250	0.030	14.40	0.15	14.41	0.15	14.80	0.15	−0.470	−0.460	−0.070	0.05	10
32910 1994 TE15	15.340	0.091	14.850	0.076	0.300	0.100	14.50	0.15	14.79	0.15	14.50	0.15	−0.840	−0.550	−0.840	0.16	10
32953 1996 GF19	15.030	0.071	14.540	0.050	0.240	0.110)	14.70	0.15	14.57	0.15	14.70	0.15	−0.330	−0.460	−0.330	0.07	10
33788 1999 RL240	13.180	0.208	12.800	0.202	0.120	0.080)	12.80	0.15	12.80	0.15	13.10	0.15	−0.380	−0.380	−0.080	0.44	10
34442 2000 SS64	14.540	0.071	14.160	0.050	0.120	0.080)	14.30	0.15	14.19	0.15	14.00	0.15	−0.240	−0.350	−0.540	0.83	10
34706 2001 OP83	15.070	0.142	14.580	0.133	0.240	0.110)	14.70	0.15	14.74	0.15	14.70	0.15	−0.370	−0.330	−0.370	0.13	10
35107 1991 VH	16.980	0.058			0.280	0.030	16.90	0.15	16.69	0.15	16.90	0.15	−0.080	−0.290	−0.080	0.08	8
35389 1997 XO	14.690	0.116	14.310	0.104	0.120	0.080)	14.40	0.15	14.29	0.15	14.30	0.15	−0.290	−0.400	−0.390	0.18	10
35396 1997 XF11	16.770	0.085			0.060	0.040	16.90	0.15	16.70	0.15	16.90	0.15	0.130	−0.070	0.130	0.73	10
35430 1998 BT6	15.690	0.091	15.200	0.076	0.240	0.110)	15.20	0.15	15.09	0.15	15.50	0.15	−0.490	−0.600	−0.190	0.82	10
36368 2000 OG12	15.510	0.116	15.020	0.104	0.240	0.110)	15.00	0.15	15.01	0.15	15.30	0.15	−0.510	−0.500	−0.210	0.00	10
36492 2000 QW46	15.045	0.167	14.610	0.133	0.240	0.110)	14.50	0.15	14.37	0.15	14.50	0.15	−0.545	−0.675	−0.545	0.00	10
37655 Illapa	18.010	0.161	17.520	0.153	0.240	0.110)	17.90	0.15	17.75	0.15	17.70	0.15	−0.110	−0.260	−0.310	0.11	10
38995 2000 UJ24	14.770	0.116	14.390	0.104	0.120	0.080)	14.50	0.15	14.43	0.15	14.40	0.15	−0.270	−0.340	−0.370	0.31	10
39076 2000 VL22	15.205	0.145	14.770	0.104	0.120	0.080)	14.70	0.15	14.69	0.15	14.70	0.15	−0.505	−0.515	−0.505	0.35	10
39783 1997 LB1	14.020	0.116	13.640	0.104	0.120	0.080)	13.70	0.15	13.64	0.15	13.70	0.15	−0.320	−0.380	−0.320	0.36	10
40267 1999 GJ4	16.080	0.208	15.590	0.202	0.500	0.200	15.40	0.15	15.28	0.15	15.25	0.15	−0.680	−0.800	−0.830	1.01	10
42314 2001 VQ121	14.660	0.208	14.170	0.202	0.120	0.080)	14.30	0.15	14.08	0.15	14.30	0.15	−0.360	−0.580	−0.360	1.00	10
43183 1999 XK213	14.340	0.116	13.960	0.104	0.120	0.080)	14.00	0.15	14.02	0.15	14.00	0.15	−0.340	−0.320	−0.340	0.46	10
45810 2000 QP32	15.320	0.116	14.830	0.104	0.240	0.110)	14.90	0.15	14.72	0.15	14.90	0.15	−0.420	−0.600	−0.420	0.16	10
46824 1998 MT38	15.900	0.116	15.410	0.104	0.240	0.110)	15.40	0.15	15.17	0.15	15.40	0.15	−0.500	−0.730	−0.500	0.00	10
50822 2000 FH35	14.620	0.066	14.240	0.042	0.120	0.080)	14.30	0.15	14.21	0.15	14.30	0.15	−0.320	−0.410	−0.320	0.08	10
51911 2001 QD68	13.520	0.084	13.140	0.067	0.120	0.080)	13.10	0.15	13.06	0.15	13.10	0.15	−0.420	−0.460	−0.420	0.32	10
52762 1998 MT24	14.690	0.208	14.200	0.202	0.000	0.200	14.70	0.15	14.61	0.15	14.60	0.15	0.010	−0.080	−0.090	0.40	10
53435 1999 VM40	14.910	0.084	14.420	0.067	0.200	0.040	14.60	0.15	14.48	0.15	14.52	0.15	−0.310	−0.430	−0.390	0.25	10
58207 1992 EF14	16.500	0.116	16.120	0.104	0.120	0.080)	15.80	0.15	15.76	0.15	15.80	0.15	−0.700	−0.740	−0.700	0.28	10
61263 2000 OR28	15.460	0.116	14.970	0.104	0.240	0.110)	14.80	0.15	14.83	0.15	14.80	0.15	−0.660	−0.630	−0.660	0.30	10
62112 2000 RM99	13.880	0.099	13.500	0.085	0.120	0.080)	13.70	0.15	13.46	0.15	13.70	0.15	−0.180	−0.420	−0.180	0.73	10
63634 2001 QU86	15.170	0.099	14.680	0.085	0.240	0.110)	15.30	0.15	14.58	0.15	15.30	0.15	0.130	−0.590	0.130	0.63	10
64588 2001 XX3	14.230	0.142	13.740	0.133	0.240	0.110)	13.70	0.15	13.65	0.15	13.70	0.15	−0.530	−0.580	−0.530	0.83	10
65803 Didymos	18.160	0.042			0.200	0.020	18.00	0.15	17.95	0.15	17.95	0.15	−0.160	−0.210	−0.210	0.08	8
66063 1998 RO1	18.050	0.077	17.560	0.058	0.120	0.050	18.10	0.15	17.95	0.15	17.95	0.15	0.050	−0.100	−0.100	0.13	8
66335 1999 JZ61	13.900	0.091	13.410	0.076	0.240	0.110)	13.50	0.15	13.37	0.15	13.50	0.15	−0.400	−0.530	−0.400	0.47	10
67751 2000 UF48	14.805	0.126	14.370	0.076	0.180	0.100)	14.40	0.15	14.46	0.15	14.40	0.15	−0.405	−0.345	−0.405	0.36	10
68905 2002 JZ104	15.860	0.142	15.370	0.133	0.240	0.110)	15.50	0.15	15.31	0.15	15.50	0.15	−0.360	−0.550	−0.360	0.14	10
69230 Hermes	17.570	0.124			0.150	0.200	17.50	0.15	17.48	0.15	17.48	0.15	−0.070	−0.090	−0.090	0.06	8
71200 1999 XT236	14.885	0.126	14.450	0.076	0.120	0.080)	14.60	0.15	14.54	0.15	14.60	0.15	−0.285	−0.345	−0.285	0.00	10
73371 2002 KA13	15.690	0.116	15.310	0.104	0.120	0.080)	15.80	0.15	15.36	0.15	15.80	0.15	0.110	−0.330	0.110	0.27	10
74355 1998 WJ12	14.760	0.116	14.270	0.104	0.240	0.110)	14.40	0.15	14.25	0.15	14.40	0.15	−0.360	−0.510	−0.360	0.15	10
76818 2000 RG79	14.260	0.095			0.450	0.100	13.50	0.15	13.44	0.15	13.43	0.15	−0.760	−0.820	−0.830	0.14	10
85938 1999 DJ4	18.600	0.208	18.110	0.202	0.060	0.100	18.60	0.15	18.48	0.15	18.49	0.15	0.000	−0.120	−0.110	0.11	8
87426 2000 QH101	15.285	0.109	14.850	0.042	0.180	0.100)	15.10	0.15	14.94	0.15	15.60	0.15	−0.185	−0.345	0.315	0.14	10
88188 2000 XH44	16.530	0.208	16.040	0.202	0.350	0.200	16.00	0.15	15.95	0.15	15.90	0.15	−0.530	−0.580	−0.630	0.06	10
88710 2001 SL9	18.070	0.084	17.580	0.067	0.460	0.130	17.60	0.15	17.44	0.15	17.43	0.15	−0.470	−0.630	−0.640	0.08	8
88850 2001 SL222	15.630	0.077	15.250	0.058	0.120	0.080)	15.90	0.15	15.27	0.15	15.90	0.15	0.270	−0.360	0.270	0.22	10
89136 2001 US16	20.290	0.116	19.800	0.104	0.300	0.100	20.20	0.15	20.17	0.15	20.18	0.15	−0.090	−0.120	−0.110	0.90	10
89355 2001 VS78	15.740	0.208	15.250	0.202	0.100	0.100	15.60	0.15	15.47	0.15	15.45	0.15	−0.140	−0.270	−0.290	0.50	10
91810 1999 TQ249	14.770	0.208	14.390	0.202	0.120	0.080)	14.40	0.15	14.39	0.15	15.30	0.15	−0.370	−0.380	0.530	0.20	10
93195 2000 SV112	15.935	0.145	15.500	0.104	0.180	0.100)	15.60	0.15	15.67	0.15	16.30	0.15	−0.335	−0.265	0.365	0.52	10
95868 2003 GB29	14.460	0.208	14.080	0.202	0.120	0.080)	14.20	0.15	14.17	0.15	14.20	0.15	−0.260	−0.290	−0.260	0.74	10
98015 2000 QS215	16.820	0.116	16.330	0.104	0.240	0.110)	16.60	0.15	16.06	0.15	16.80	0.15	−0.220	−0.760	−0.020	0.77	10
99475 2002 CR118	15.120	0.208	14.630	0.202	0.240	0.110)	14.40	0.15	14.29	0.15	14.80	0.15	−0.720	−0.830	−0.320	0.74	10
99907 1989 VA	18.000	0.202			0.230	0.110)	17.90	0.15	17.81	0.15	17.78	0.15	−0.100	−0.190	−0.220	0.15	12
100111 1993 FA51	15.040	0.116	14.660	0.104	0.120	0.080)	14.80	0.15	14.77	0.15	14.80	0.15	−0.240	−0.270	−0.240	0.00	10
101610 1999 CW7	16.510	0.114			0.240	0.110)	16.10	0.15	15.98	0.15	16.10	0.15	−0.410	−0.530	−0.410	0.38	10
103067 1999 XA143	16.990	0.152	16.500	0.143	0.240	0.110)	16.60	0.15	16.56	0.15	16.51	0.15	−0.390	−0.430	−0.480	0.49	10
105612 2000 RT99	14.450	0.077	13.960	0.058	0.240	0.110)	14.10	0.15	13.98	0.15	14.40	0.15	−0.350	−0.470	−0.050	0.00	10
113846 2002 TV239	16.930	0.116	16.440	0.104	0.240	0.110)	16.40	0.15	16.28	0.15	16.10	0.15	−0.530	−0.650	−0.830	0.20	10
114205 2002 VF105	15.910	0.208	15.420	0.202	0.240	0.110)	15.20	0.15	15.20	0.15	15.20	0.15	−0.710	−0.710	−0.710	0.90	10
114319 2002 XD58	15.940	0.124	15.450	0.114	0.240	0.110)	15.60	0.15	15.44	0.15	15.60	0.15	−0.340	−0.500	−0.340	0.14	10
119409 2001 TH72	15.860	0.116	15.370	0.104	0.240	0.110)	15.60	0.15	15.59	0.15	16.10	0.15	−0.260	−0.270	0.240	1.28	10
125922 2001 XR234	15.630	0.208	15.250	0.202	0.120	0.080)	15.50	0.15	15.62	0.15	15.80	0.15	−0.130	−0.010	0.170	0.71	10
126267 2002 AN86	16.100	0.124	15.610	0.114	0.240	0.110)	15.50	0.15	15.58	0.15	15.60	0.15	−0.600	−0.520	−0.500	0.00	10
131739 2001 YJ115	16.600	0.208	16.110	0.202	0.240	0.110)	16.20	0.15	15.93	0.15	16.30	0.15	−0.400	−0.670	−0.300	0.00	10
138971 2001 CB21	18.710	0.163			0.240	0.110)	18.40	0.15	18.36	0.15	18.41	0.15	−0.310	−0.350	−0.300	0.19	10
139345 2001 KA67	17.060	0.170	16.570	0.163	0.240	0.110)	16.70	0.15	16.66	0.15	16.74	0.15	−0.360	−0.400	−0.320	0.20	10
144411 2004 EW9	16.620	0.170	16.130	0.163	0.240	0.110)	16.60	0.15	16.55	0.15	16.55	0.15	−0.020	−0.070	−0.070	0.90	10
151803 2003 FE58	16.690	0.208	16.200	0.202	0.240	0.110)	16.40	0.15	16.41	0.15	16.40	0.15	−0.290	−0.280	−0.290	0.00	10
153002 2000 JG5	18.580	0.170	18.090	0.163	0.240	0.110)	18.10	0.15	17.97	0.15	18.02	0.15	−0.480	−0.610	−0.560	0.85	10

Table 2 (*continued*)

Asteroid		H	δH	H_R	δH_R	G	δG	H_{MPC}	G_{MPC}	H_{AsD}	G_{AsD}	H_{JPL}	G_{JPL}	$H_{\mathrm{MPC}}-H$	$H_{\mathrm{AsD}}-H$	$H_{\mathrm{JPL}}-H$	Ampl.	Reference(s)
159669	2002 GY73	15.530	0.066	15.150	0.042	0.120	0.080)	15.30	0.15	15.29	0.15	15.50	0.15	−0.230	−0.240	−0.030	0.27	10
162210	1999 SM5	19.360	0.116	18.870	0.104	0.200	0.070	19.10	0.15	19.08	0.15	19.10	0.15	−0.260	−0.280	−0.260	0.77	10
162635	2000 SS164	16.980	0.180	16.490	0.173	0.240	0.110)	16.40	0.15	16.40	0.15	16.36	0.15	−0.580	−0.580	−0.620	0.86	10
163373	2002 PZ39	19.100	0.116	18.610	0.104	0.240	0.110)	18.90	0.15	18.79	0.15	18.79	0.15	−0.200	−0.310	−0.310	0.10	10
167208	Lelekovice	16.985	0.145	16.550	0.104	0.120	0.080)	16.20	0.15	16.69	0.15	16.20	0.15	−0.785	−0.295	−0.785	0.25	10
168318	1989 DA	19.080	0.104			0.230	0.110)	18.90	0.15	18.84	0.15	18.83	0.15	−0.180	−0.240	−0.250	0.12	12
175706	1996 FG3	17.760	0.042			−0.070	0.020	18.20	0.15	18.38	0.15	18.00	0.15	0.440	0.620	0.240	0.08	7
176505	2001 YF29	16.210	0.116	15.720	0.104	0.240	0.110)	16.00	0.15	15.89	0.15	16.00	0.15	−0.210	−0.320	−0.210	0.56	10
183532	2003 GC27	15.440	0.116	15.060	0.104	0.120	0.080)	15.00	0.15	15.07	0.15	15.00	0.15	−0.440	−0.370	−0.440	0.84	10
185851	2000 DP107	18.020	0.202			0.000	0.100	18.20	0.15	18.15	0.15	18.15	0.15	0.180	0.130	0.130	0.18	8
188228	2002 TH267	16.690	0.208	16.200	0.202	0.150	0.200)	16.30	0.15	16.39	0.15	16.30	0.15	−0.390	−0.300	−0.390	0.20	10
190978	2001 XD101	15.990	0.116	15.500	0.104	0.240	0.110)	15.50	0.15	15.46	0.15	15.20	0.15	−0.490	−0.530	−0.790	0.58	10
196698	2003 SV77	15.930	0.116	15.550	0.104	0.120	0.080)	15.70	0.15	15.61	0.15	15.70	0.15	−0.230	−0.320	−0.230	0.27	10
205744	2002 BK25	18.330	0.116	17.840	0.104	0.240	0.110)	18.10	0.15	18.01	0.15	18.07	0.15	−0.230	−0.320	−0.260	0.00	10
206079	2002 RU66	15.120	0.116	14.740	0.104	0.120	0.080)	14.90	0.15	14.81	0.15	14.90	0.15	−0.220	−0.310	−0.220	0.00	10
206400	2003 SW52	17.020	0.116	16.530	0.104	0.240	0.110)	16.50	0.15	16.42	0.15	16.50	0.15	−0.520	−0.600	−0.520	0.37	10
210999	2001 XR49	15.390	0.066	15.010	0.042	0.120	0.080)	15.40	0.15	15.19	0.15	15.40	0.15	0.010	−0.200	0.010	0.00	10
211349	2002 TB120	15.970	0.116	15.480	0.104	0.240	0.110)	15.40	0.15	15.29	0.15	15.40	0.15	−0.570	−0.680	−0.570	0.73	10
213665	2002 SS50	16.220	0.091	15.840	0.076	0.120	0.080)	16.20	0.15	15.68	0.15	16.20	0.15	−0.020	−0.540	−0.020	0.18	10
217628	Lugh	16.830	0.114			0.230	0.110)	16.30	0.15	16.24	0.15	16.20	0.15	−0.530	−0.590	−0.630	0.08	12
219525	2001 QG97	16.410	0.116	15.920	0.104	0.240	0.110)	15.90	0.15	15.94	0.15	15.60	0.15	−0.510	−0.470	−0.810	0.18	10
232067	2001 UR220	15.340	0.084	14.960	0.067	0.120	0.080)	15.60	0.15	15.06	0.15	15.60	0.15	0.260	−0.280	0.260	0.29	10
237442	1999 TA10	18.470	0.099	17.980	0.085	0.240	0.110)	18.00	0.15	18.04	0.15	17.90	0.15	−0.470	−0.430	−0.570	0.10	10
250365	2003 SJ307	16.710	0.116	16.220	0.104	0.240	0.110)	15.90	0.15	15.72	0.15	15.90	0.15	−0.810	−0.990	−0.810	0.47	10
250719	2005 SN21	15.530	0.208	15.150	0.202	0.120	0.080)	15.50	0.15	15.20	0.15	15.50	0.15	−0.030	−0.330	−0.030	0.82	10
252591	2001 XO1	16.090	0.071	15.710	0.050	0.120	0.080)	15.90	0.15	15.77	0.15	15.90	0.15	−0.190	−0.320	−0.190	0.30	10
254070	2004 HK42	16.115	0.109	15.680	0.042	0.180	0.100)	15.60	0.15	15.59	0.15	15.60	0.15	−0.515	−0.525	−0.515	0.22	10
257838	2000 JQ66	18.250	0.099	17.760	0.085	0.430	0.080)	17.70	0.15	17.70	0.15	17.58	0.15	−0.550	−0.550	−0.670	0.60	10
267494	2002 JB9	16.320	0.161	15.830	0.153	0.240	0.110)	16.00	0.15	15.82	0.15	15.68	0.15	−0.320	−0.500	−0.640	0.21	10
267729	2003 FC5	18.610	0.180	18.120	0.173	0.240	0.110)	18.20	0.15	18.25	0.15	18.25	0.15	−0.410	−0.360	−0.360	0.50	10
282631	2005 SV1	15.630	0.116	15.250	0.104	0.120	0.080)	15.60	0.15	15.35	0.15	15.60	0.15	−0.030	−0.280	−0.030	0.31	10
293743	2007 RL45	17.090	0.208	16.600	0.202	0.240	0.110)	16.80	0.15	16.61	0.15	16.80	0.15	−0.290	−0.480	−0.290	0.00	10
301844	1990 UA	19.710	0.085			0.230	0.110)	19.70	0.15	19.62	0.15	19.61	0.15	−0.010	−0.090	−0.100	0.10	12
	1989 VB	19.940	0.124			0.230	0.110)	19.90	0.15	19.90	0.15	19.92	0.15	−0.040	−0.040	−0.020	0.32	12
	1990 UP	20.450	0.104			0.230	0.110)	21.30	0.15	21.27	0.15	21.16	0.15	0.850	0.820	0.710	0.80	12
	1994 AW1	17.400	0.202			0.150	0.200	17.50	0.15	17.42	0.15	17.33	0.15	0.100	0.020	−0.070	0.12	8
	1994 CB	21.400	0.202			0.150	0.200	21.00	0.15	21.02	0.15	21.02	0.15	−0.400	−0.380	−0.380	0.90	5
	1998 QR15	18.450	0.161	17.960	0.153	0.240	0.110)	18.10	0.15	18.02	0.15	17.93	0.15	−0.350	−0.430	−0.520	0.11	10
	1998 QR52	19.070	0.107	18.580	0.095	0.240	0.110)	18.70	0.15	18.70	0.15	18.68	0.15	−0.370	−0.370	−0.390	0.88	10
	1999 JO8	17.100	0.170	16.610	0.163	0.240	0.110)	16.90	0.15	16.94	0.09	16.97	0.15	−0.200	−0.160	−0.130	0.09	10
	1999 PJ1	18.410	0.133	17.920	0.124	0.240	0.110)	18.00	0.15	17.96	0.15	18.06	0.15	−0.410	−0.450	−0.350	1.10	10
	2000 QN130	18.230	0.208	17.740	0.202	−0.150	0.200	18.10	0.15	17.92	0.15	17.83	0.15	−0.130	−0.310	−0.400	0.30	10
	2000 UG11	20.970	0.104			0.320	0.100	20.40	0.15	20.32	0.15	20.30	0.15	−0.570	−0.650	−0.670	0.10	8
	2000 WL107	24.440	0.202			0.150	0.200)	24.80	0.15	24.64	0.15	24.33	0.15	0.360	0.200	−0.110	1.10	10
	2001 TX16	14.160	0.121	13.740	0.114	0.120	0.080)	14.00	0.15	13.97	0.15	14.10	0.15	−0.160	−0.190	−0.060	0.47	10
	2002 FD6	22.510	0.152	22.020	0.143	0.240	0.110)	22.30	0.15	22.25	0.15	22.26	0.15	−0.210	−0.260	−0.250	0.20	10
	2002 NY40	19.230	0.202			0.150	0.200)	19.00	0.15	18.96	0.15	19.19	0.15	−0.230	−0.270	−0.040	1.30	10
	2002 TD60	19.900	0.099	19.410	0.085	0.550	0.100	19.30	0.15	19.22	0.15	19.21	0.15	−0.600	−0.680	−0.690	1.60	10
	2003 AJ73	18.930	0.107	18.440	0.095	0.240	0.110)	18.60	0.15	18.48	0.15	18.48	0.15	−0.330	−0.450	−0.450	0.96	10
	2003 AK18	19.880	0.133	19.390	0.124	0.240	0.110)	19.70	0.15	19.64	0.15	19.64	0.15	−0.180	−0.240	−0.240	0.19	10
	2003 FG	19.570	0.116	19.080	0.104	0.240	0.110)	19.70	0.15	19.72	0.15	19.72	0.15	0.130	0.150	0.150	1.40	10
	2003 SR84	25.440	0.152	24.950	0.143	0.240	0.110)	26.00	0.15	25.86	0.15	25.85	0.15	0.560	0.420	0.410	0.83	10
	2004 JR1	17.620	0.161	17.130	0.153	0.120	0.080)	17.60	0.15	17.55	0.15	17.55	0.15	−0.020	−0.070	−0.070	0.13	10
	2004 XO14	16.330	0.062	15.840	0.036	0.160	0.020	16.10	0.15	16.10	0.15	16.10	0.15	−0.230	−0.230	−0.230	0.21	10
	2005 AB	17.390	0.066	16.900	0.042	−0.010	0.010	17.50	0.15	17.49	0.15	17.48	0.15	0.110	0.100	0.090	0.07	10
	2005 SQ73	18.160	0.099	17.670	0.085	0.240	0.110)	17.40	0.15	17.40	0.15	17.40	0.15	−0.760	−0.760	−0.760	0.30	10
	2005 TQ27	15.690	0.208	15.310	0.202	0.120	0.080)	15.40	0.15	15.36	0.15	15.40	0.15	−0.290	−0.330	−0.290	0.49	10

The catalog absolute magnitudes and slope parameters were taken from the MPC's file mpcorb.dat dated 2011 November 27 ($H_{\mathrm{MPC}}, G_{\mathrm{MPC}}$), from the AstDyS files allnum.cat, ufitobs.cat and singopp.cat dated 2011 December 16 ($H_{\mathrm{AsD}}, G_{\mathrm{AsD}}$), and from the JPL Horizons files elements.numbr and elements.unnum dated 2011 November 24 ($H_{\mathrm{JPL}}, G_{\mathrm{JPL}}$). The references for the H and G estimates, their uncertainties δH and δG and the lightcurve amplitudes are following: (1) Harris and Young (1989), (2) Harris et al. (1989), (3) Harris et al. (1992), (4) Harris et al. (1999), (5) Pravec et al. (1996), (6) Pravec et al. (1998), (7) Pravec et al. (2000), (8) Pravec et al. (2006), (9) Pravec et al. (2012), (10) Pravec et al., http://www.asu.cas.cz/~ppravec/newres.htm, (11) Reddy et al. (2007), and (12) Wisniewski et al. (1997). In the columns H_R and δH_R, the absolute magnitudes in the Cousins R band and their uncertainties are given for asteroids where all our measurements were in R and the H value was derived from H_R by adding $(V-R)$ value (see Section 2.4). Assumed G and δG values are flagged with ")" after the uncertainty value.

3. Accuracy and biases of the orbit catalog *H* values

We compared the H estimates for asteroids in our sample with H values from the orbit catalogs MPCORB, Pisa AstDyS and JPL Horizons.[6] We list the differences $(H_{\mathrm{MPCORB}}-H)$, $(H_{\mathrm{AstDyS}}-H)$ and $(H_{\mathrm{JPL}}-H)$ in Table 2 and plot them vs H in Figs. 1–3.

Generally, the catalog H values are good in the range of small H (large asteroids). There are small or no systematic offsets: the mean difference between the catalog and our H estimate is +0.040, +0.047 and −0.001 mag for MPCORB, AstDyS and JPL Horizons, respectively, and the standard deviations are 0.104–0.134 mag in the smallest H ranges (see Table 3). Though these standard deviations are greater than most of the estimated uncertainties δH for the large asteroids, they are actually not much greater than a typical dispersion of H with observing aspect (see Section 2.6). So, the catalog H

---

[6] In the AstOrb catalog, they adopt the MPCORB H values for numbered asteroids; we study the data from the three catalogs with independently calculated H values.

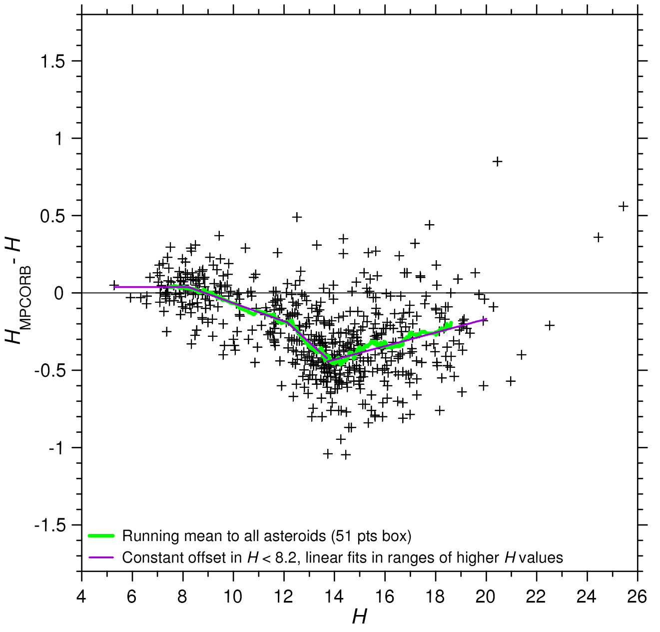

Fig. 1. Differences between the MPCORB catalog values and our absolute magnitude estimates are plotted. Parameters of the lines fitted to the data are given in Table 3.

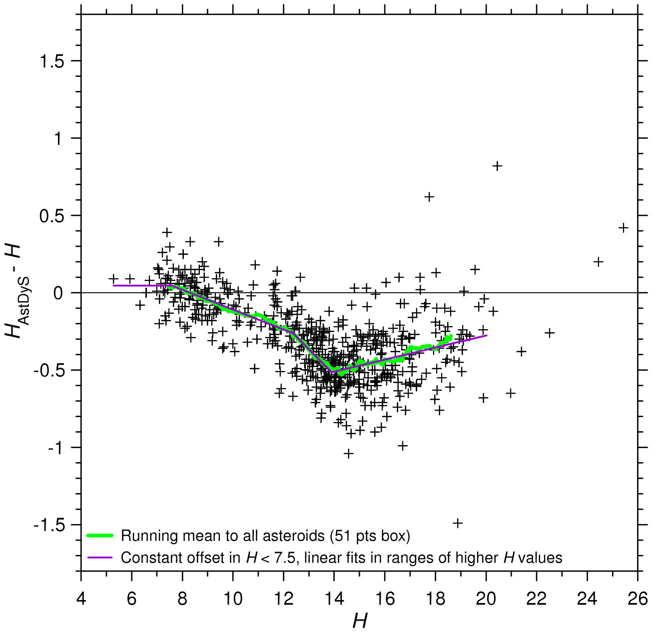

Fig. 2. Differences between the Pisa AstDyS catalog values and our absolute magnitude estimates are plotted. Parameters of the lines fitted to the data are given in Table 3.

values for the largest asteroids are almost as good as they could be estimated without pole and shape modeling.

Going to smaller sizes (higher H values), we see a systematic offset to negative ($H_{\rm catalog} - H$) values (i.e., the catalog H data being systematically too bright on average) with similar behaviors, but differing in some details in the three catalogs. To analyse the behavior of the mean offset of the catalog H values, we plotted the running mean curves with a box size of 51 data points in Figs. 1–3 and we approximated the dependence by fitting a constant offset to points with the smallest H and linear functions in specific ranges of H; their parameters are given in Table 3. The "break points" separating the different fitted ranges were chosen somewhat arbitrarily at H values near points where the running mean curve changes slope substantially and where the adjacent fitted lines cross. We set the cut-off H = 20 for our analysis as we have only a few points with greater H. However, we note that the number density of points in our sample decreases in the range H = 17–20. Thus, even though we see no prominent change of trends in the range of fainter H (see below), we point out that the catalog H bias in the range $H \gtrsim 17$ (where near-Earth asteroids predominate in the asteroid catalogs and our sample) will need to be studied on a larger sample in the future.

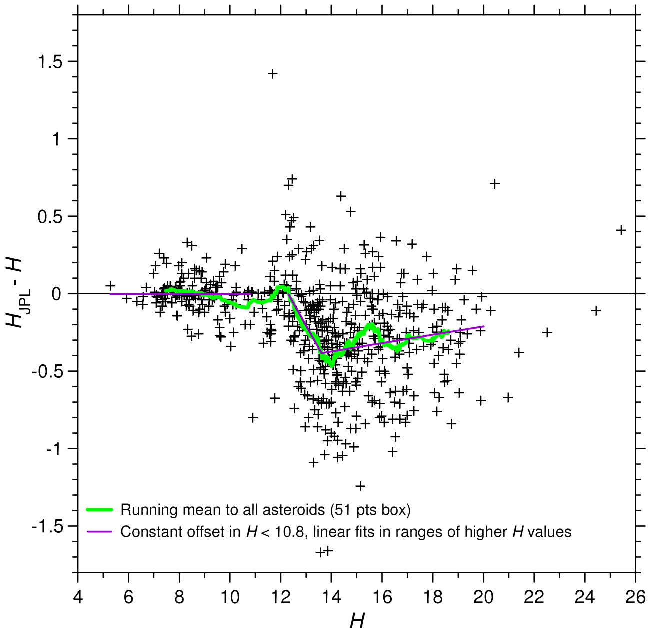

Fig. 3. Differences between the JPL Horizons catalog values and our absolute magnitude estimates are plotted. Parameters of the lines fitted to the data are given in Table 3. We did not fit a line in the range H = 10.8–12.3 due to the small number of points affected by a few big outliers there.

Table 3
Parameters of the linear fits in Figs. 1–3, ($H_{\rm catalog} - H$) = $aH + b$.

Catalog	H range	N	a	b	σ
MPCORB	<8.2	53	0	0.040	0.102
	8.2–12.1	125	−0.0585	0.520	0.162
	12.1–13.7	124	−0.1478	1.603	0.200
	13.7–20.0	274	0.0438	−1.044	0.242
AstDyS	<7.5	26	0	0.047	0.134
	7.5–12.3	160	−0.0643	0.535	0.144
	12.3–13.9	138	−0.1660	1.793	0.152
	13.9–20.0	256	0.0390	−1.056	0.218
JPL Horizons	<10.8	139	0	−0.001	0.116
	12.3–13.6	107	−0.2909	3.576	0.348
	13.6–20.0	285	0.0270	−0.750	0.322

N is the number of fitted points in the given range of H, σ is the standard deviation of the points from the fitted line.

The common features of the H data in the three catalogs are the following: The mean ($H_{\rm catalog} - H$) reaches a minimum (i.e., maximum negative offset) at $H \sim 14$. The negative offset increases steeply in the range from $H \sim 12.2$ to $\sim$13.7, but then it decreases rather slowly from 14 to 20.

Some interesting differences between the H data in the catalogs are following: The standard deviation of the MPCORB H data increases fairly gradually with increasing H, from $\sigma = 0.102$ mag in the smallest H range, through 0.162 and 0.200 mag in the ranges centered at H around 10 and 13, to 0.242 mag in the range $H = 14–20$. The AstDyS data show, however, a higher consistency over a wider range of H, with σ increasing only slightly from 0.134 mag for the brightest asteroids to 0.152 mag for data in the range around $H = 13$, and their data in the highest H range of 14–20 are also internally the most consistent ones of all the three catalogs, with the smallest σ of 0.218 mag. The JPL Horizons data show the most diverse behavior. They are internally pretty consistent with $\sigma = 0.116$ mag and zero mean offset up to $H \sim 11$ where there begin to occur big outliers and their data become quite noisy above $H = 12$, with a standard deviation $\sigma \sim 0.33$ mag between $H = 12.3$ and 20.

The observed trends of the systematic offsets of the catalog H values are quite curious. We will discuss their possible causes in Section 5. First, in the following subsections we analyse certain correlations of the mean offset with taxonomic types and lightcurve amplitude.

3.1. Correlation of the mean offset with taxonomic classes

In Figs. 4–6, there are highlighted data for asteroids with known taxonomic types that uniquely classify the asteroids as medium- or low-albedo. The former group are asteroids that have been classified as S, A or L types, while the latter are those classified as C, G, B, F, P or D types. The taxonomy data were taken from Tholen (1989), Bus and Binzel (2002), DeMeo et al. (2009), Xu et al. (1995), and Lazzaro et al. (2004) as compiled in Neese (2010).

Among asteroids with H greater than $\sim$10 in our sample, most of those with known taxonomic types are medium-albedo ones. This is not surprising, as among the intrinsically fainter asteroids, there are fewer with established low-albedo taxonomic classes as those concentrate in outer parts of the main belt and thus they are mostly seen at fainter apparent magnitudes and so they are more difficult to be observed spectro-photometrically. Another reason was that our photometric observational projects sampling the range $H > 12$ concentrated on inner-main belt and near-Earth asteroids where S and similar types dominate in the visual bands (having a higher number density in the H parameter space), so these types predominate in our sample at higher H values too, though we have got some low-albedo ones among the targeted and especially the accidentally imaged asteroids as well (see Section 4). As the statistics of asteroids with known low-albedo types in the $H > 10$ range is poor, we limit ourselves to analysing correlations of the mean offset with taxonomic classes to the range $H < 10$ only.

Among large asteroids with $H \lesssim 10$, there appears to be a significant systematic difference between the medium and low-albedo mean offsets. The difference is of nearly the same magnitude of 0.09 mag in the MPCORB and the Pisa AstDyS catalogs, but it is smaller, 0.043 mag, in the JPL Horizons catalog. Specifically, for points with $H < 9.5$, the mean of $(H_{\mathrm{MPCORB}} - H)$ values for the low- and the medium-albedo type asteroids are +0.064 and -0.024 mag, respectively. The mean of $(H_{\mathrm{AstDyS}} - H)$ values for the low- and the medium-albedo type asteroids are +0.044 and -0.048 mag, respectively. The mean of $(H_{\mathrm{JPL}} - H)$ values for the low- and the medium-albedo type asteroids are +0.024 and -0.019 mag, respectively.

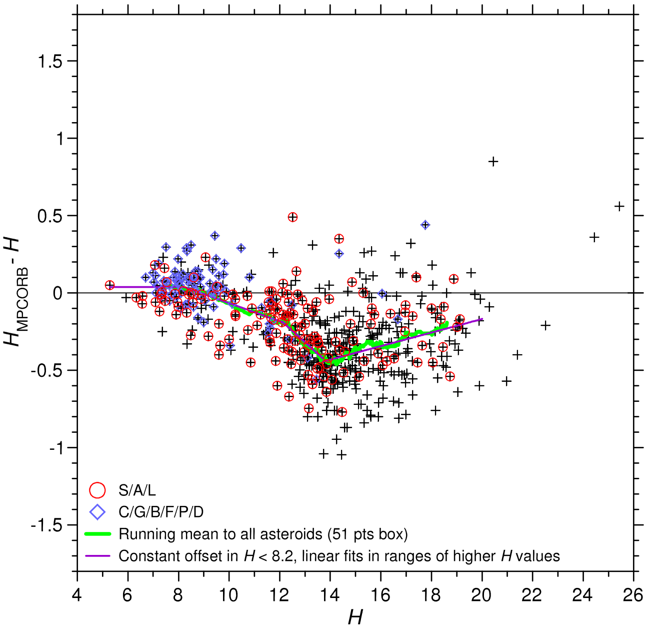

Fig. 4. Systematic offset between the MPCORB absolute magnitudes of medium (S, A, L) and low-albedo types (C, G, B, F, P, D) is apparent especially among bright asteroids with $H < 10$.

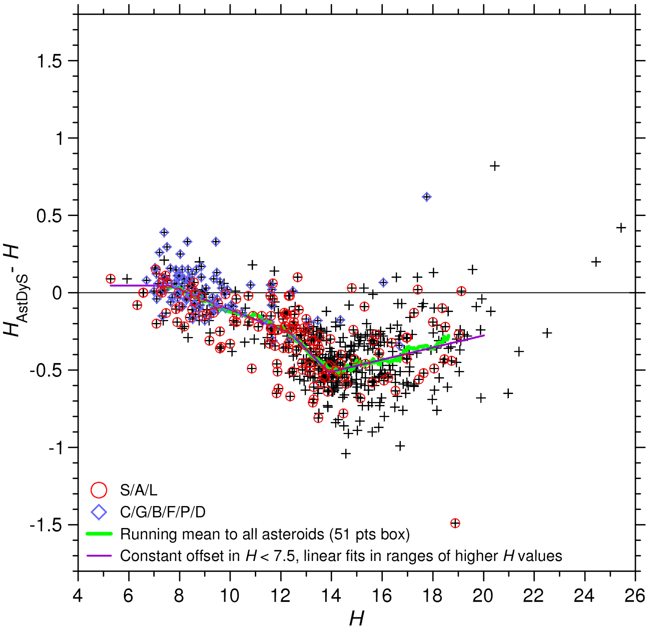

Fig. 5. As in Fig. 4, but for the AstDyS catalog absolute magnitudes.

We suspect that a reason for the observed "albedo dispersion", with large low-albedo (mostly C type) asteroids having a systematically positive H offset while large medium-albedo (mostly S type) having a systematically negative H offset in the catalogs, is because the orbit computers assumed one default value for G of 0.15 for most asteroids in their computations of the absolute magnitudes from astrometric magnitude estimates. Another effect may be that of an assumed single value of $(V - R) = 0.40$ they used for conversion of astrometric magnitude estimates that were made effectively in the R band where the maximum sensitivity of standard CCDs lies. As S types actually have higher mean G and $(V - R)$, while C types have lower mean G and $(V - R)$ than the default values, the H values derived by the orbit computers for asteroids of the two different albedo-type groups are offset in the opposite directions.

3.2. Correlation of the mean offset with lightcurve amplitude

There is apparent a small correlation of the $(H_{\mathrm{catalog}} - H)$ values with asteroid lightcurve amplitude. In Figs. 7–9, there are highlighted 140 (of the 583) asteroids with amplitude $\geqslant 0.4$ mag. The high-amplitude asteroids show a slightly greater negative mean H offset, as shown by the running mean plotted in the figures which is shifted down by a few 0.01 mag to ∼0.1 mag from the mean offset curve for all asteroids, at most H values. Except for the small increase of the mean negative catalog H offset, the $(H_{\mathrm{catalog}} - H)$ values of high amplitude asteroids do not show a substantially greater dispersion around the mean curve than low amplitude ones.

There are a few possible reasons for high-amplitude asteroids showing the greater negative offset of the catalog H values. The astrometric observers could have made their magnitude estimates more often from images taken when the asteroid was brighter than its mean light. It might be intentional for some follow-up observers, e.g., due to their aim to do more accurate astrometry on images with higher signal-to-noise ratio, so they might choose to measure images taken closer to the lightcurve maximum rather than minimum. But it could also be a natural consequence of the flux-limited observations, both by the surveys and follow-up stations; a high-amplitude asteroid with mean brightness close to the signal-to-noise ratio limit of a given astrometric program is positively detected more frequently close to the lightcurve maximum than minimum. Another cause might be that high-amplitude asteroid observations are more likely to be taken at asteroid aspects close to equator-on where asteroids show lower mean cross-section than at aspects of higher asterocentric latitudes. So the mean absolute magnitude estimated at times when an asteroid shows a higher amplitude is typically fainter than the mean H estimated at an average aspect, if the asteroid's pole obliquity is not close to 0 or 180°.

3.3. Biases in the data sample

As we analysed only a small sample of 583 asteroids, we have to be careful about possible biases present in the data set. However, our careful analysis suggested that there are not present biases in the H data sample greater than 0.1 mag. We discuss them below.

The potentially strongest bias is that our sample is predominately S/S-like asteroids at small sizes (below ∼25 km). The mean negative offset of the catalog H values we found is thus representative for those types at small sizes, and it may be lower by ∼0.1 mag for C/C-like types if the correlation of the offset with taxonomic classes that we see among large asteroids (Section 3.2) is present at smaller sizes as well.

Another bias worth considering is that our sample is predominately inner main belt asteroids in the range $H = 11$–16. If the H offset actually depends on apparent magnitude observed by the astrometric surveys rather than on H as we assumed in our analysis, the curve of mean $(H_{\mathrm{catalog}} - H)$ vs H will be shifted to lower H values (to the left in Figs. 1–9) for asteroids in the central and outer main belt. We estimate that the leftward shift of the mean $(H_{\mathrm{catalog}} - H)$ curve could be several 0.1 mag up to ∼1 mag for the more distant asteroids, i.e., the maximum of the negative offset of the catalog H values could be shifted down to $H \sim 13$ for outer main belt asteroids. (See also the last paragraph of Section 3.4 where we discuss the result of Romanishin and Tegler (2005) who found a similar catalog H bias for Trans-Neptunian Objects and Centaurs.)

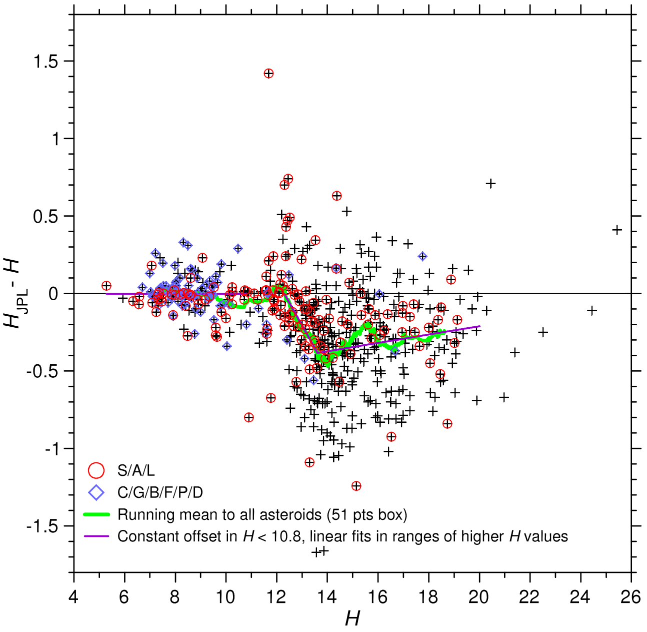

Fig. 6. As in Fig. 4, but for the JPL Horizons catalog absolute magnitudes.

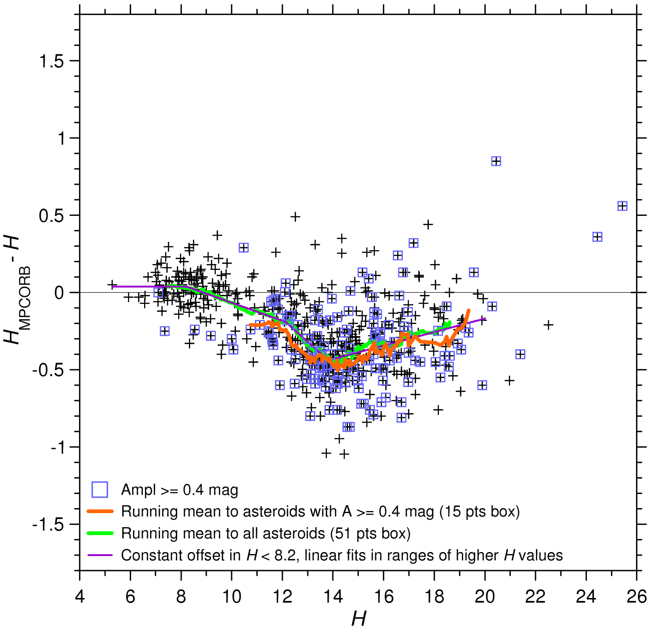

Fig. 7. A higher negative mean offset of the MPCORB absolute magnitudes for high-amplitude asteroids is shown.

Other observational selection effects that may be present in our sample are not likely to cause a significant bias in our derived H offset. Our procedure described in Section 2 somewhat favored asteroids with moderate lightcurve amplitudes. A bias against asteroids with low amplitudes ($\lesssim 0.1$ mag) was created as we did not obtain a good lightcurve solution for some. A bias against high-amplitude asteroids is present as well as we did not obtain an estimate for the mean brightness level with the required accuracy for some of them. These two biases in our sample affect the derived mean offset of catalog H values in opposite directions so they partially cancel out one each other. A remaining residual systematic error in the derived H offset is likely not greater than a few 0.01 mag; as we showed in Section 3.2, even fairly high-amplitude asteroids with $A > 0.4$ mag have the mean negative H offset greater by ∼0.1 mag only.

A selection effect against slow rotators, which could be moderate in our sample, is not likely to have a significant effect to the derived H offset as slow rotators have similar lightcurve amplitudes

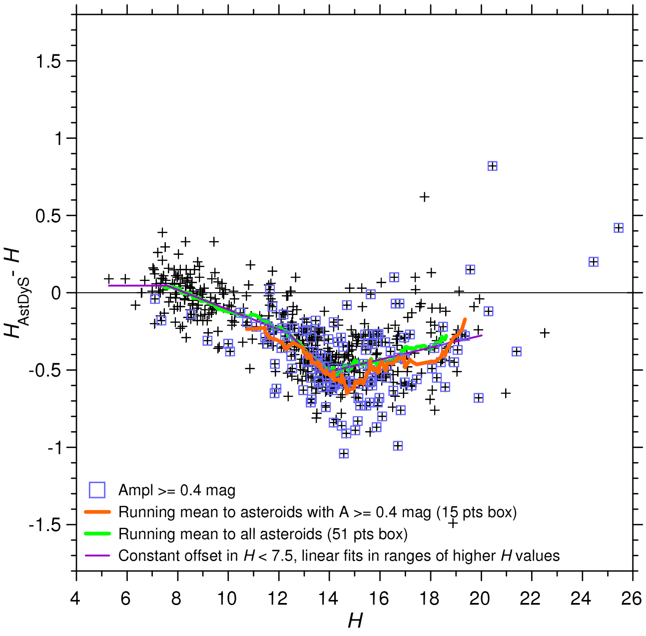

Fig. 8. As in Fig. 7, but for the AstDyS catalog absolute magnitudes.

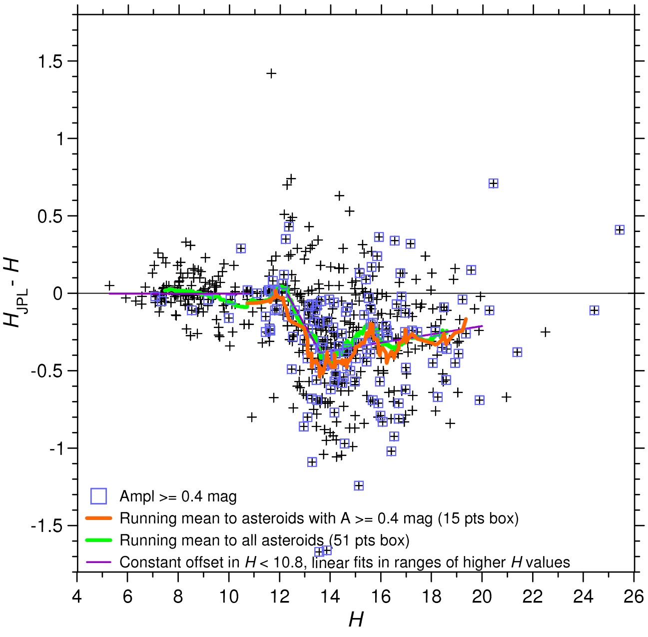

Fig. 9. As in Fig. 7, but for the JPL Horizons catalog absolute magnitudes.

as faster rotators with periods 4–20 h that predominate among asteroids of sizes we studied.

A bias introduced by assuming the mean ($V - R$) in converting H_R to H, according to the taxonomy class predominating in their respective orbital groups for asteroids where we had not a classification (see Section 2.4), cannot be greater than a few 0.01 mag. Even in the worst possible case of the equal visually observed ratio of S and C types in an orbital group, assuming a S (or C) type's mean ($V - R$) for all asteroids in the group would introduce a systematic error in the estimated mean catalog H offset of 0.055 mag (see Table 1); in existing asteroid groups with a predominating type, the resulting systematic error in the estimated mean H offset will be lower.

A small bias could be introduced also by assuming G values for some asteroids, at the mean G value for their known classification or a class predominating in their orbital group (see Section 2.3). However, we estimate that a resulting bias in the estimated mean catalog H offset is likely to be on an order of 0.01 mag only. The correlation between G and taxonomic classification is well established, so using the mean G of the known classes for some asteroids in our sample does not create a systematic error in the derived mean H offset. A systematic error can be introduced by a presence of interlopers of different taxonomic classes among cases where we assumed a class according to the asteroid's orbital group membership, analogously to what we described in the previous paragraph on the color index-related systematic effect. A difference between the mean G values of the S and C classes of 0.12 (see Section 2.3) propagates to a systematic error in the derived H for a C-type asteroid for which the S-type's mean G is assumed of 0.05 mag at solar phase of 15° (about the mean solar phase of the observations of our asteroid sample). So, even in the worst possible case of the equal visually observed ratio of S and C types in an orbital group, assuming the S (or C) type's mean G for asteroids in the group would introduce a systematic error in the estimated mean catalog H offset of 0.025 mag; in existing asteroid groups with a predominating type, the resulting systematic error in the estimated mean H offset will be lower. And since we had to assume G for a part of, not all asteroids in our sample, a resulting combined systematic error in the derived mean catalog H offset for the whole sample can be about 0.01 mag only.

3.4. Comparison with earlier works

The systematic offset of the H values in orbit catalogs was mentioned by several asteroid photometrists before. Parker et al. (2008) compared Johnson V data derived from the photometric measurements from the Sloan Digital Sky Survey (SDSS) Moving Object Catalog 4 for a sample of about 64,000 asteroids observed at solar phases between 3° and 15° to their apparent magnitudes (V_c) predicted from the H and G values from the AstOrb catalog.[7] They found the mean ($V_c - V$) = −0.23 mag. A correction of this offset to zero phase to obtain ($H_c - H$), accounting for a difference between actual G values of the asteroids and the default $G = 0.15$ assumed for most asteroids in AstOrb, is estimated to be about −0.02 mag, assuming a mean solar phase of the SDSS observations of 9° and a mean $G = 0.18$ for asteroids in the sample (corresponding to a 50:50 ratio between S/S-like and C/C-like asteroids in the sample). The resulting mean ($H_{\text{AstOrb}} - H$) $\simeq -0.25$ mag is within the range of mean ($H_{\text{MPCORB}} - H$) that we found changing from −0.17 to −0.43 for H from 20.0 to 14.0 where most of the asteroids in the SDSS sample lie. To do an exact comparison, we will have to compute a weighted mean ($H_{\text{MPCORB}} - H$) for the particular distribution of the H values in the SDSS sample; this is a subject of future work.

Jurić et al. (2002) undertook an analysis similar to Parker et al. (2008), though on an earlier and smaller sample, but they compared the SDSS magnitudes to both the AstOrb and MPCORB magnitudes, and they also considered a correlation of the offset with asteroid color. Specifically, they compared Johnson V data derived from the photometric measurements in the Sloan Digital Sky Survey (SDSS) Early Data Release, a sample of 1335 asteroids, to their apparent magnitudes (V_c) predicted from the H and G data from the AstOrb and MPCORB catalogs. They found the mean ($V_{\text{AstOrb}} - V$) = −0.41. They estimated the correction to zero phase to be −0.02 ± 0.01, which gives the mean ($H_{\text{AstOrb}} - H$) = −0.43 for their sample. They also report the mean ($V_{\text{MPCORB}} - V$) ~ -0.2; we

---

[7] See footnote 6 for comments on the correspondence between the H values in the AstOrb and MPCORB catalogs.

speculate that the difference between the offsets of the two catalogs may reflect the different magnitude correction/weighting schemes the two orbit computer groups used at that time.[8]

The MPCORB offset they found is somewhat lower than the offset we obtained for asteroids with similar absolute magnitudes; for H in the range 12–16, we found an average $(H_{\mathrm{MPCORB}} - H)$ of -0.36. A reason for the lower offset they found ten years ago is unclear. One possible cause is that the asteroid surveys predominating in the last ten years might produce more biased magnitude estimates than the (same or different) surveys did before 2002, or possibly the MPC's correction/weighting scheme for estimating H values from magnitude estimates worked better for the surveys operating before 2002 than during the last ten years. In any case, users of the H values from orbit catalogs should be aware that the offset of the catalog values can change with time due to development on the side of asteroid surveys (possible changes in photometric reduction procedures, or simply new surveys with their individual biases starting or increasing their relative contribution to the magnitude estimates data and older ones lessening or stopping their operation) or on the side of orbit computers (e.g., new correction and weighting schemes for magnitude estimates used in computing the H values).

They also found a correlation of the apparent magnitude offset with the SDSS asteroid color, with the median offsets of the AstOrb magnitudes $(V_c - V)$ of -0.34 and -0.44 for subsamples of blue and red asteroids, respectively. It is similar to the difference of 0.09 mag between the mean offsets for S/A/L (predominantly S) and C/G/B/F/P/D (predominantly C) types we found among large asteroids (see Section 3.1). There may be a common cause; Jurić et al. speculate similarly that it may be due to the assumed single value of $(V - R)$ used by the orbit computers for conversion of the astrometric magnitude estimates made in the red band to V for asteroids of different colors.

Galád (2010) analysed the SDSS data for 64 asteroids with measured rotation periods, estimated their mean H values and compared them to MPCORB. For his sample covering a range of $H = 9.2$–17.7 (median $H = 15.4$), he found an average $(H_{\mathrm{MPCORB}} - H) = -0.28$, its formal error (mean error of the mean) is ± 0.03. A correction of the offset, which he estimated assuming $G = 0.15$ for most asteroids in his sample, for an actual estimated mean $G = 0.19$ (for the ratio of 38:26 between S/S-like and C/C-like asteroids in his sample) is estimated to be -0.03 mag. The resulting corrected mean $(H_{\mathrm{MPCORB}} - H) = -0.31 \pm 0.03$ is within 2σ of a weighted mean of the $(H_{\mathrm{MPCORB}} - H)$ offset of -0.36 we computed for his SDSS asteroids sample from our results given in the first part of this Section 3, so there is a reasonable agreement. Galád also discussed a small correlation between the catalog absolute magnitudes offset and lightcurve amplitude, which would be in agreement with our results in Section 3.2, but his finding was not statistically significant at a level greater than 1σ for the small sample he analysed.

Romanishin and Tegler (2005) compared H values computed from their photometric measurements for 90 Trans-Neptunian Objects (TNOs) and Centaurs with the data from the MPC and JPL Horizons catalogs. They found an average difference of -0.29 and -0.34 mag, respectively. This is a similar mean offset as we found for small MBAs and NEAs. It is interesting to see that the survey and astrometric follow-up observations of outer Solar System objects were apparently affected by the same or similar photometry problem as the astrometric observations of cis-jovian asteroids. A noteworthy point is that the Romanishin and Tegler's H values cannot contain any significant error due to uncertainties in G values, as the TNOs were observed at very low solar phase angles so any uncertainty in G propagated to a negligible error in H. The presence of the similar catalog H offset for both groups of Solar System objects, the small MBA/NEAs and the larger TNOs/Centaurs, suggests that the bias in catalog H values may be actually related to apparent observed magnitude rather than H that we assumed in our H data analysis above; see our discussion in the third paragraph of Section 3.3. Despite their different sizes/absolute magnitudes, objects of both groups were observed mostly at faint apparent magnitudes, most often not much above the magnitude limits of the surveys; this may provide a clue to identify (and correct, eventually) a common cause for the catalog H offset for both groups of Solar System bodies.

4. Revised *WISE* albedos

We revised the estimates of asteroid albedos and diameters made by Masiero et al. (2011) and Mainzer et al. (2011b) within their NEOWISE project, using our H data and the recalculation method of Harris and Harris (1997). We outline our application of the method here.

The relationship between the effective diameter, geometric albedo, and absolute magnitude is

$$D\sqrt{p_V}10^{H/5} = K, \tag{1}$$

where

$$K \equiv 2\ \mathrm{AU} \times 10^{V_{\mathrm{Sun}}/5} = 1329 \pm 10\ \mathrm{km}. \tag{2}$$

(See Pravec and Harris, 2007, for its derivation from the definition of those parameters plus the apparent magnitude of the Sun at 1 AU, V_{Sun}, which includes the definition of the V magnitude scale.) The geometric and Bond albedos are related by

$$A_V \equiv qp_V, \tag{3}$$

where q is the phase integral. On the H–G system, q is derived from G via

$$q = 0.290 + 0.684G. \tag{4}$$

A basic assumption of the method is that the quantity $(1 - A_V)D^2$ is invariant. This can be used with Eqs. (1)–(4) to compute the revised value of albedo

$$p_{V_{\mathrm{rev}}} = \left[q_{\mathrm{rev}} + (1 - qp_V)\frac{D^2}{K^2}10^{0.4H_{\mathrm{rev}}}\right]^{-1}, \tag{5}$$

where H_{rev} is the new value of H, q and q_{rev} are old and new values of the phase integral (Eq. (3)), corresponding to old and new values of the slope parameter, G and G_{rev}. The revised diameter D_{rev} then follows from Eq. (1). We point out that the NEOWISE diameter estimates were generally stable and our revised diameters differ from theirs by an insignificant amount; a diameter estimate resulting from the thermal modeling is almost insensitive to uncertainty in H (see Harris and Harris, 1997).

The reason for this modification of the Harris&Harris method is that most of the H values tabulated in Masiero et al. (2011) and Mainzer et al. (2011b) are "starting values" in their calculations and not their final solution values of H, which in some cases came from band 1 or 2 flux measurements by *WISE* itself. Their solution H value, which they do not list, that corresponds with their tabulated (D, p_V) solutions can be recovered using Eq. (1).[9] We modified the Harris& Harris formulation, as given in Eq. (5), to use the tabu-

---

[8] Unlike in our work where our sample consists of numbered asteroids mostly and their AstOrb H values were taken from MPCORB (see footnote 6), the sample of Jurić et al. (2002) had a much greater fraction of (then-)unnumbered asteroids for which there were independent H estimates in the AstOrb catalog.

[9] For example, H, D, and p_V tabulated for (70) Panopaea in Masiero et al. (2011) are (8.110, 139.007 km, and 0.0397). 8.11 is the catalog value of H from MPCORB, not the self-consistent value matching $D = 139.007$ km and $p_V = 0.0397$. From our Eq. (1), the solution value of H corresponding to the tabulated D and p_V can be recovered to be $H = 8.405$.

lated solution values of D and p_V, rather than H, according to the condition given by Eq. (1).

The original as well as the revised data are listed in Table 4. For the original values, we give uncertainties that were computed from the formal uncertainties listed in the *WISE* data files (see below Table 4) with quadratically adding the minimum systematic error of 10% and 20% of diameter and albedo, respectively.[10] As shown in Harris and Harris (1997), the uncertainties in D are unchanged with the application of the recalculation method; the revised diameter values have the same uncertainties as the *WISE* δD values listed in the third data column of the table. The uncertainties of the revised p_V were computed with Eq. (8) of Harris and Harris (1997), from δD and δH values.

The revised albedo and diameter data are plotted in Fig. 10. We highlighted points of known low-, medium- and high-albedo type asteroids; non-highlighted points are ones for which we have no or contradicting classifications. The mean p_V and the standard deviation (dispersion) of the sample are 0.057 (±0.013) and 0.197 (±0.051) for the Tholen/Bus/DeMeo C/G/B/F/P/D and the S/A/L types, respectively. The standard errors of the mean albedos are 0.002 and 0.006, respectively, but we caution that systematic observational or modeling errors may be greater than these formal errors (see below).

Mainzer et al. (2011a) showed an apparent trend of S-type asteroids having higher albedos at smaller diameters, see their Figs. 1 and 2. They suspected that it was an artifact in the data rather than a real feature of the asteroid population, and they suggested that it could be due to "selection biases against small, low albedo objects". We confirm their suspicion that the apparent albedo trend with size they saw was an artifact. Our data reveal that it was largely due to the systematic bias of MPCORB H values for smaller asteroids in the range $H > 10$. From our revised p_V–D dataset, there is apparent only little difference between large and small S/A/L type asteroids; the mean p_V is 0.178 ± 0.008 and 0.209 ± 0.008 for S/A/L type asteroids larger and smaller than $D = 25$ km, respectively. The difference between the mean albedos of 0.031 is only marginally significant, as the formal standard error of the difference, propagated from the mean errors of the means of p_V values in the two size ranges, is 0.011. This minor difference might be a real feature with smaller S-type asteroids having slightly brighter surfaces, possibly due to being less space weathered or having different scattering properties, but it could also be a small residual artifact as we note in the following paragraphs.

There were probably present two observational selection effects that could cause a small bias towards higher albedos even within a given taxonomy group. The first effect is that spectroscopic observations from which the taxonomic classifications were derived were likely biased to asteroids with higher albedos, as they got a higher signal-to-noise ratio, S/N, for a higher than for a lower albedo asteroid with same size and observing conditions. The second effect is that our photometric observations could be somewhat biased towards higher albedo asteroids too; two asteroids of same size and albedos different by 25% (e.g., 0.25 vs 0.20, or 0.071 vs 0.057) have H different by 0.24 mag. This is not a big difference but nevertheless it could cause a small bias as we might get a good solution more likely for the higher albedo asteroid that we observed at S/N greater by 10–20% (depending on a predominating noise source in the photometric observations) than the lower albedo one of same size and in same observing conditions.

So, our sample of taxonomically classified asteroids should be indeed somewhat biased towards brighter albedos even within a given taxonomy group, and the bias may be greater for small asteroids than for large ones, as the observational selection effects may be more prominent for fainter asteroids that were observed at lower S/N typically. A future work will be needed to estimate a magnitude of the bias and whether it explains the apparent difference of 0.031 between the mean albedos of small and large S/A/L types.

Finally, we note that the dispersion of the estimated albedos in both taxonomy groups, $\sigma(p_V)/\overline{p_V} = 0.013/0.057 \doteq 0.23$ for the C/C-like types and $0.051/0.197 \doteq 0.26$ for the S/S-like types, is only slightly greater than the expected typical albedo error; Mainzer et al. (2011a) wrote that for estimates from *WISE* observations, "the minimum albedo error is ~20% of the value of the albedo". This means that a substantial part of the dispersion of the p_V estimates in both taxonomy groups could be actually due to errors in the albedo estimates rather than a real dispersion in albedos of members of the groups. Both taxonomy groups might be actually more tight, i.e., have a smaller dispersion in albedo than the sample dispersion of the estimated values.

5. Possible causes for the offset in catalog *H* values

Most of the procedures that astrometric surveys, follow-up observers, and orbit calculators used for estimating the apparent magnitudes of asteroids and derivation of the H values have not been comprehensively published so far. Thus we cannot rigorously determine causes of the offset in the catalog H values. We present a few reasonable guesses and speculations in following.

The large offset seen for asteroids in the range of ± a few magnitudes about $H = 14$, which are mostly main belt asteroids in our sample, may be related to the fact that many of their astrometric observations could not be done much above the magnitude limits of the most productive surveys, especially when observed close to aphelion or at higher solar elongation away from opposition. Results of photometric reduction of faint asteroid images are sensitive to quality of flat field, accuracy of estimation of the sky background level and quality of background objects removal.

Another possible way for how main belt asteroids with $H > 12$ could have biased magnitude estimates is if the few surveys which took most of their observations had some flaws in their photometric reduction procedures, or in the method by which they reported the magnitude estimates to the MPC. For instance, if observations taken with a clear or no filter are reported without a filter code, the magnitude estimates are taken as B band observations—for the B band being the default for astrometric magnitude estimates, a standard inherited from the days of photographic plates—and converted to V by subtracting $(B - V) \sim 0.8$ (about the mean asteroidal color index), resulting in extremely incorrect magnitudes. Or if observations calibrated using local standards with magnitudes in the Johnson R system are erroneously reported as V, then they are off by about -0.4 or -0.5 mag, depending on the $(V - R)$ color index of a given asteroid. We do not know whether the above two, or some other errors, occurred for reported asteroid magnitude estimates frequently enough that they could cause the huge offset. A thorough check of procedures of reducing and reporting magnitude estimates used by the major surveys would be advisable.

An explanation for why the trend reverses above $H = 14$, with the mean offset in the MPCORB values being about half as large at $H \sim 19$ than at ~ 14 may be related to the fact that there is an increasing proportion of near-Earth asteroids (NEAs) with increasing H in the sample. A turning point is about $H = 16$; while most of the asteroids in our sample in the range $H = 15$–16 are main belt asteroids (there are 17 NEAs among the 62 asteroids in this H range), most of those in $H = 16$–17 are NEAs (29 of 44). It may be

---

[10] Mainzer et al. (2011a) wrote that "the minimum diameter error that can be achieved using *WISE* observations is ~10% and the minimum albedo error is ~20% of the value of the albedo". Realistic uncertainties of the *WISE* diameter and albedo estimates are computed as $\delta D = \sqrt{(\delta D_{\mathrm{formal}})^2 + (0.1D)^2}$ and $\delta p_V = \sqrt{(\delta p_{V\,\mathrm{formal}})^2 + (0.2p_V)^2}$.

Table 4
WISE diameter and albedo data.

Asteroid		*WISE*					*H*	*G*	Revised			Taxon.						
		G	*D* (km)	δD (km)	p_V	δp_V			*D* (km)	p_V	δp_V	(0)	(1)	(2)	(3)	(4)	(5)	(6)
8	Flora	0.28	140.000	14.048	0.2614	0.0712	6.560	0.320	138.814	0.2179	0.0494	S	S		Sw			
9	Metis	0.17	199.591	20.414	0.1343	0.0376	6.330	0.230	199.959	0.1298	0.0304	S	S				T	T
11	Parthenope	0.15	159.108	16.985	0.1585	0.0483	6.570	0.240	160.091	0.1623	0.0352	S	S	Sk	Sq			
12	Victoria	0.22	126.643	13.062	0.1400	0.0312	7.060	0.220	127.343	0.1633	0.0340	SL	S	L			D	D
17	Thetis	0.15	93.335	9.696	0.1597	0.0332	7.900	0.230	93.337	0.1403	0.0321	S	S	Sl	S			
19	Fortuna	0.10	223.000	48.968	0.0499	0.0222	7.152	0.162	223.193	0.0489	0.0215	CG	G	Ch	Ch			
24	Themis	0.19	202.336	21.120	0.0641	0.0203	7.088	0.180	202.248	0.0631	0.0133	CB	C	B	C		B	C
30	Urania	0.15	98.408	10.070	0.1711	0.0481	7.530	0.230	99.006	0.1753	0.0363	S	S	Sl	S			
31	Euphrosyne	0.15	280.000	66.916	0.0454	0.0454	6.700	0.090	279.821	0.0471	0.0226	C	C	Cb				
38	Leda	0.15	116.000	19.361	0.0617	0.0204	8.315	0.090	115.858	0.0621	0.0209	C	C	Cgh	Cgh			
45	Eugenia	0.07	206.141	21.531	0.0458	0.0107	7.422	0.130	206.290	0.0446	0.0094	CF	FC	C				
46	Hestia	0.06	124.000	15.707	0.0520	0.0154	8.400	0.120	124.089	0.0501	0.0128	PX	P	Xc				
47	Aglaja	0.16	138.000	17.715	0.0672	0.0162	7.861	0.178	138.038	0.0665	0.0172	CB	C	B			B	B
53	Kalypso	0.15	115.000	15.454	0.0400	0.0103	8.660	0.090	115.025	0.0459	0.0125	CX	XC			C		
57	Mnemosyne	0.15	122.466	13.117	0.1817	0.0593	7.090	0.220	122.731	0.1711	0.0371	S	S	S	S		S	S
58	Concordia	0.15	92.307	9.358	0.0592	0.0129	8.860	0.090	92.195	0.0594	0.0133	C	C	Ch	Ch		Caa	Cgh
60	Echo	0.27	60.000	6.956	0.1905	0.0453	8.484	0.250	60.028	0.1980	0.0462	S	S	S				
70	Panopaea	0.14	139.007	14.424	0.0397	0.0120	8.100	0.130	139.327	0.0524	0.0113	C	C	Ch	Cgh			
71	Niobe	0.40	92.842	9.307	0.2475	0.0604	7.310	0.400	92.753	0.2446	0.0535	SX	S	Xe				
72	Feronia	0.15	79.478	8.182	0.0742	0.0171	8.790	0.000	79.302	0.0856	0.0178	SDTG	TDG			STD		
75	Eurydike	0.23	68.593	7.137	0.0979	0.0240	8.970	0.230	68.578	0.0970	0.0204	MX	M	Xk				
76	Freia	0.15	158.567	17.770	0.0486	0.0121	7.864	0.070	158.400	0.0503	0.0114	CPX	P	X	C			
77	Frigga	0.16	67.180	6.778	0.1530	0.0553	8.522	0.160	67.176	0.1527	0.0311	MX	MU	Xe	Xe			
99	Dike	0.15	71.311	7.993	0.0587	0.0181	9.350	0.090	71.282	0.0633	0.0162	CX	C	Xk	Xk			
102	Miriam	0.15	87.033	8.960	0.0458	0.0111	9.300	0.090	86.930	0.0445	0.0124	CP	P	C				
107	Camilla	0.08	219.374	22.727	0.0540	0.0156	7.100	0.090	219.378	0.0530	0.0111	CX	C	X			X	X
109	Felicitas	0.04	89.000	10.827	0.0705	0.0169	8.759	0.030	88.971	0.0700	0.0171	CG	GC	Ch			Caa	Ch
114	Kassandra	0.15	100.000	14.428	0.0877	0.0232	8.275	0.090	99.798	0.0868	0.0252	XTK	T	Xk	K			
125	Liberatrix	0.33	61.122	6.208	0.1153	0.0355	8.900	0.220	61.058	0.1305	0.0269	MX	M	X				
130	Elektra	0.15	198.933	20.313	0.0714	0.0178	6.990	0.090	198.641	0.0716	0.0150	CG	G	Ch	Ch		Caa	Ch
133	Cyrene	0.13	80.487	8.265	0.1759	0.0390	7.990	0.130	80.452	0.1738	0.0361	S	SR	S	S		S	S
134	Sophrosyne	0.28	112.200	15.572	0.0440	0.0181	8.770	0.280	112.188	0.0436	0.0122	C	C	Ch				
135	Hertha	0.15	77.000	10.984	0.1520	0.0585	8.100	0.240	77.697	0.1684	0.0487	MX	M	Xk				
137	Meliboea	0.15	144.000	18.287	0.0514	0.0148	8.100	0.090	143.788	0.0492	0.0128	C	C					
139	Juewa	0.15	164.000	30.077	0.0446	0.0249	7.924	0.150	163.995	0.0444	0.0164	CPX	CP	X				
145	Adeona	0.15	151.000	18.066	0.0434	0.0124	8.050	0.090	150.952	0.0467	0.0116	C	C	Ch			Caa	Ch
146	Lucina	0.11	131.812	14.026	0.0534	0.0146	8.277	0.186	131.893	0.0496	0.0107	C	C	Ch				
154	Bertha	0.15	188.755	19.466	0.0461	0.0096	7.530	0.090	188.647	0.0483	0.0107	C		C			C	Cb
156	Xanthippe	0.15	110.718	11.286	0.0504	0.0157	8.310	−0.120	110.409	0.0687	0.0152	C	C	Ch			Caa	Ch
159	Aemilia	0.15	127.434	13.029	0.0614	0.0158	8.100	0.090	127.300	0.0627	0.0142	C	C	Ch				
163	Erigone	0.04	81.579	8.714	0.0330	0.0079	9.480	−0.040	81.611	0.0428	0.0092	C	C	Ch				
166	Rhodope	0.15	54.551	5.667	0.0657	0.0196	9.750	0.090	54.564	0.0747	0.0160	CXG	GC:	Xe			X	Xk
187	Lamberta	0.15	133.014	13.534	0.0642	0.0163	7.980	−0.040	132.457	0.0647	0.0135	C	C	Ch				
189	Phthia	0.15	40.559	4.075	0.1991	0.0467	9.600	0.230	40.381	0.1566	0.0349	S	S	Sa				
201	Penelope	0.24	88.092	9.241	0.0967	0.0202	8.540	0.170	87.720	0.0881	0.0187	MX	M	X	Xk			
211	Isolda	0.12	143.000	25.929	0.0603	0.0214	7.900	0.120	142.986	0.0598	0.0218	C	C	Ch				
216	Kleopatra	0.29	138.000	23.786	0.1111	0.0403	7.350	0.280	137.794	0.1068	0.0370	MX	M	Xe	Xe			
218	Bianca	0.32	56.766	5.777	0.1972	0.0585	8.607	0.310	56.735	0.1979	0.0407	S	S					
219	Thusnelda	0.15	38.078	3.921	0.2280	0.0499	9.340	0.230	38.279	0.2214	0.0471	SL	S				S	L
226	Weringia	0.15	37.003	3.721	0.1527	0.0324	9.820	0.230	37.154	0.1510	0.0322	S		S	S		S	Sk
230	Athamantis	0.27	109.000	16.984	0.1710	0.0835	7.346	0.272	109.025	0.1713	0.0536	S	S	Sl				
236	Honoria	0.02	92.319	9.464	0.1109	0.0281	8.188	−0.020	92.168	0.1104	0.0228	SL	S	L	L			
261	Prymno	0.19	54.245	5.591	0.1006	0.0335	9.440	0.190	54.244	0.1005	0.0209	BX	B	X				
266	Aline	0.15	109.000	21.323	0.0597	0.0236	8.490	0.090	108.867	0.0599	0.0238	C	C	Ch	Ch		Caa	Ch
288	Glauke	0.15	32.100	3.685	0.1722	0.0492	10.000	0.230	32.245	0.1699	0.0502	S	S	S	S			
317	Roxane	0.15	19.859	1.990	0.5252	0.1313	10.070	0.490	20.410	0.3975	0.0805	EX	E	Xe				
322	Phaeo	0.15	73.155	7.418	0.0771	0.0188	8.990	0.090	73.123	0.0837	0.0178	XD	X	X	D			
335	Roberta	0.15	89.703	9.093	0.0588	0.0163	8.860	0.130	89.734	0.0627	0.0129	BFP	FP	B				
338	Budrosa	0.15	65.783	6.598	0.1646	0.0430	8.370	0.230	66.350	0.1800	0.0365	MX	M	Xk				
344	Desiderata	0.15	125.970	12.672	0.0652	0.0225	8.030	0.090	125.870	0.0684	0.0141	C	C					
345	Tercidina	0.10	99.000	15.151	0.0591	0.0168	8.810	0.210	99.109	0.0538	0.0169	C	C	Ch	Ch			
346	Hermentaria	0.15	91.810	9.291	0.2949	0.0883	7.250	0.230	91.912	0.2632	0.0543	S	S	S	S			
347	Pariana	0.15	51.000	6.030	0.2130	0.0594	8.890	0.210	50.955	0.1891	0.0459	M	M					
379	Huenna	0.15	87.472	9.060	0.0654	0.0153	8.990	0.140	87.336	0.0587	0.0123	CB	B	C				
388	Charybdis	0.07	124.202	12.634	0.0427	0.0110	8.580	0.070	124.195	0.0423	0.0088	C	C	C			X	X
392	Wilhelmina	0.15	68.930	6.915	0.0542	0.0147	9.590	0.090	68.854	0.0543	0.0110	C		Ch				
423	Diotima	0.15	177.254	18.811	0.0664	0.0142	7.320	0.090	177.011	0.0665	0.0143	C	C	C				
429	Lotis	0.15	70.000	9.678	0.0425	0.0165	9.890	0.070	69.888	0.0400	0.0111	C	C				X	Xk
453	Tea	0.15	26.139	2.644	0.1182	0.0287	10.850	0.230	26.223	0.1174	0.0273	S	S	S	Sw			
464	Megaira	0.15	78.294	8.080	0.0421	0.0108	9.470	0.090	78.293	0.0469	0.0100	CFX	FXU:	C				
478	Tergeste	0.15	77.252	7.860	0.1902	0.0474	7.960	0.230	77.714	0.1914	0.0403	SL	S	L				

Table 4 (*continued*)

Asteroid		*WISE*					*H*	*G*	Revised			Taxon.						
		G	*D* (km)	δD (km)	p_V	δp_V			*D* (km)	p_V	δp_V	(0)	(1)	(2)	(3)	(4)	(5)	(6)
482	Petrina	0.15	62.585	6.310	0.1320	0.0281	8.910	0.230	62.686	0.1227	0.0262	S	S					
486	Cremona	0.15	19.007	1.916	0.1640	0.0384	10.880	0.230	19.317	0.2105	0.0462	–						
488	Kreusa	0.15	150.000	18.796	0.0590	0.0253	7.800	0.090	149.833	0.0597	0.0160	C	C				Caa	Ch
505	Cava	0.03	105.000	11.419	0.0576	0.0259	8.640	0.010	104.935	0.0561	0.0124	CF	FC					
519	Sylvania	0.15	43.944	4.426	0.2020	0.0585	9.180	0.230	44.114	0.1931	0.0394	S	S	S				
539	Pamina	0.15	43.724	4.387	0.1218	0.0286	10.040	0.090	43.361	0.0905	0.0202	C		Ch			Caa	Ch
540	Rosamunde	0.15	20.274	2.031	0.2241	0.0686	10.740	0.230	20.368	0.2154	0.0506	S	S					
542	Susanna	0.15	52.501	5.256	0.1158	0.0359	9.640	0.240	52.372	0.0897	0.0195	S	S					
556	Phyllis	0.15	38.517	3.873	0.1787	0.0486	9.520	0.200	38.688	0.1836	0.0379	S	S	S				
558	Carmen	0.15	58.572	5.948	0.1170	0.0306	9.170	0.210	58.632	0.1104	0.0228	M	M				X	Xk
560	Delila	0.15	35.078	3.513	0.0627	0.0172	10.800	0.090	35.070	0.0687	0.0144	B	***	B				
584	Semiramis	0.24	48.693	6.470	0.2444	0.0774	8.610	0.310	49.263	0.2618	0.0701	S	S	Sl				
587	Hypsipyle	0.15	12.944	1.298	0.1413	0.0369	12.190	0.230	12.991	0.1392	0.0315	–						
593	Titania	0.06	86.485	8.879	0.0458	0.0104	9.290	0.060	86.479	0.0454	0.0094	C	C					
606	Brangane	0.15	36.907	3.765	0.0893	0.0213	10.200	0.090	36.960	0.1075	0.0243	SLDTK	TSD	K	L			
622	Esther	0.15	29.000	6.144	0.1736	0.0711	10.240	0.230	29.104	0.1672	0.0747	S	S	S				
674	Rachele	0.15	96.002	9.830	0.2064	0.0527	7.472	0.239	96.392	0.1951	0.0407	S	S	S				
695	Bella	0.15	41.225	4.166	0.2449	0.0565	9.070	0.200	41.396	0.2427	0.0495	S	S					
712	Boliviana	0.03	127.576	13.294	0.0389	0.0093	8.330	0.030	127.806	0.0503	0.0106	CX	C	X				
722	Frieda	0.15	8.835	0.885	0.3309	0.0789	12.310	0.230	8.794	0.2721	0.0577	S				S		
728	Leonisis	0.15	7.267	0.730	0.2557	0.0579	13.000	0.230	7.245	0.2123	0.0446	AL					A	Ld
739	Mandeville	0.15	103.713	10.620	0.0514	0.0134	8.760	0.090	103.604	0.0516	0.0109	X	X	X	Xc		X	X
770	Bali	0.15	19.166	1.925	0.1732	0.0525	11.110	0.160	19.176	0.1728	0.0352	S	S					
776	Berbericia	0.34	151.113	15.657	0.0655	0.0152	7.632	0.140	150.522	0.0690	0.0144	C	C	Cgh	Cgh			
779	Nina	0.15	77.000	10.127	0.1740	0.0658	8.100	0.260	77.456	0.1694	0.0449	X		X			X	X
782	Montefiore	0.15	14.541	1.457	0.2134	0.0514	11.560	0.230	14.578	0.1976	0.0410	S	S	Sl	Sw			
795	Fini	0.15	62.649	6.719	0.0593	0.0157	9.780	0.120	62.562	0.0553	0.0123	C		C				
823	Sisigambis	0.15	15.755	1.576	0.2339	0.0551	11.370	0.230	15.742	0.2018	0.0418	–						
825	Tanina	0.15	14.611	1.463	0.1537	0.0453	11.840	0.230	14.667	0.1508	0.0316	S	SR	S				
849	Ara	0.15	84.417	8.789	0.1155	0.0283	8.330	0.210	84.615	0.1149	0.0242	M	M					
851	Zeissia	0.15	13.566	1.361	0.2191	0.0493	11.600	0.230	13.649	0.2172	0.0442	S	S					
852	Wladilena	0.15	31.087	3.121	0.1597	0.0369	10.150	0.140	31.067	0.1594	0.0324	–						
853	Nansenia	0.15	30.737	3.090	0.0323	0.0070	11.690	0.090	30.755	0.0394	0.0083	CXD	XD	Ch				
901	Brunsia	0.15	14.721	1.476	0.1888	0.0501	11.610	0.230	14.784	0.1834	0.0415	S	S					
905	Universitas	0.15	13.703	1.373	0.2188	0.0758	11.660	0.090	13.605	0.2068	0.0425	S		S				
920	Rogeria	0.15	29.683	2.980	0.0670	0.0137	11.285	0.240	29.706	0.0613	0.0135	DT	DTU					
925	Alphonsina	0.15	58.000	7.555	0.2533	0.0736	8.410	0.230	58.062	0.2266	0.0611	S	S	S	S			
929	Algunde	0.15	12.440	1.246	0.2348	0.0572	11.860	0.240	12.448	0.2055	0.0467	S		S	S		S	Sl
968	Petunia	0.15	28.983	2.910	0.1657	0.0777	10.250	0.230	29.123	0.1654	0.0344	S	S				S	Sl
980	Anacostia	0.06	95.568	9.631	0.1404	0.0307	7.855	0.060	95.553	0.1395	0.0284	SL	SU	L				
1060	Magnolia	0.15	7.110	0.721	0.2922	0.0670	12.710	0.230	7.160	0.2839	0.0602	S					S	S
1078	Mentha	0.15	13.660	1.373	0.1819	0.0522	11.900	0.230	13.675	0.1641	0.0450	S	S					
1083	Salvia	0.15	10.183	1.021	0.1945	0.0472	12.250	0.230	10.283	0.2103	0.0476	–						
1088	Mitaka	0.15	15.957	1.596	0.1588	0.0377	11.620	0.230	16.016	0.1549	0.0333	S	S	S				
1103	Sequoia	0.15	7.623	0.765	0.3044	0.0751	12.530	0.420	7.816	0.2813	0.0606	EX	E	Xk				
1117	Reginita	0.15	10.193	1.050	0.3585	0.1063	11.690	0.230	10.292	0.3516	0.0799	S					S	S
1123	Shapleya	0.15	11.939	1.198	0.2642	0.0679	11.590	0.230	12.084	0.2797	0.0658	S					S	S
1338	Duponta	0.15	7.875	0.790	0.2286	0.0533	12.798	0.200	7.885	0.2159	0.0455	–						
1367	Nongoma	0.15	9.313	0.933	0.2470	0.0563	12.300	0.230	9.371	0.2418	0.0537	SL					S	L
1376	Michelle	0.15	7.053	0.715	0.2669	0.0787	12.810	0.230	7.104	0.2630	0.0547	–						
1405	Sibelius	0.15	7.175	0.723	0.3516	0.0955	12.570	0.240	7.204	0.3191	0.0689	–						
1419	Danzig	0.15	14.059	1.409	0.2388	0.0664	11.450	0.230	14.139	0.2324	0.0558	–						
1429	Pemba	0.15	10.417	1.048	0.1709	0.0572	12.740	0.230	10.371	0.1316	0.0361	–						
1472	Muonio	0.15	8.388	0.846	0.2397	0.0921	12.620	0.240	8.421	0.2230	0.0470	–						
1629	Pecker	0.15	9.297	0.930	0.2618	0.0626	12.360	0.240	9.310	0.2318	0.0518	S		S				
1644	Rafita	0.15	15.443	1.548	0.1392	0.0330	11.860	0.230	15.482	0.1329	0.0270	S	S					
1665	Gaby	0.15	10.960	1.096	0.2681	0.0911	11.900	0.230	11.009	0.2532	0.0692	S	S				S	Sq
1689	Floris-Jan	0.15	16.122	5.206	0.1271	0.0568	11.740	0.230	16.213	0.1353	0.0877						D	D
1717	Arlon	0.15	9.128	0.928	0.2492	0.0652	12.430	0.240	9.150	0.2250	0.0501	S	S					
1718	Namibia	0.15	9.747	0.981	0.0740	0.0176	13.800	0.050	9.694	0.0568	0.0134	–						
1722	Goffin	0.15	10.446	1.053	0.2191	0.0468	12.180	0.150	10.442	0.2175	0.0486	S				S		
1736	Floirac	0.15	8.701	0.878	0.2994	0.0731	12.330	0.240	8.729	0.2711	0.0593	–						
1777	Gehrels	0.15	12.486	1.269	0.2212	0.0474	11.773	0.343	12.667	0.2151	0.0445	S		Sq				
1806	Derice	0.15	10.697	1.071	0.2474	0.0832	12.140	0.240	10.700	0.2149	0.0461	S					S	Sl
1830	Pogson	0.15	8.284	0.836	0.2361	0.0616	12.659	0.291	8.350	0.2188	0.0459	S	S	S				
1865	Cerberus	0.15	1.611	0.162	0.1360	0.0344	16.965	0.232	1.608	0.1118	0.0230	S	S	S				
1866	Sisyphus	0.15	6.597	0.686	0.2550	0.0707	12.510	0.235	6.859	0.3719	0.0932	S		S	Sw			
1967	Menzel	0.15	10.138	1.018	0.2279	0.0604	12.250	0.240	10.182	0.2145	0.0450	S				S		
1979	Sakharov	0.15	4.521	0.504	0.3574	0.0831	13.800	0.340	4.512	0.2620	0.0603	–						
1980	Tezcatlipoca	0.15	5.988	0.620	0.1373	0.0396	13.960	0.230	5.998	0.1279	0.0292	SA	SU	Sl	Sw		A	A
1991	Darwin	0.15	4.989	0.622	0.2577	0.0932	13.600	0.230	5.024	0.2541	0.0658	–						
2002	Euler	0.15	19.773	1.978	0.0416	0.0104	12.700	0.240	19.780	0.0375	0.0084	–						

(*continued on next page*)

Table 4 (*continued*)

Asteroid		*WISE*					*H*	*G*	Revised			Taxon.						
		G	*D* (km)	δD (km)	p_V	δp_V			*D* (km)	p_V	δp_V	(0)	(1)	(2)	(3)	(4)	(5)	(6)
2006	Polonskaya	0.15	4.625	0.490	0.3539	0.1189	13.350	0.420	4.804	0.3498	0.0782	–						
2049	Grietje	0.15	2.457	0.276	0.1684	0.0462	15.600	0.420	2.495	0.1633	0.0477	–						
2094	Magnitka	0.15	12.053	1.207	0.1278	0.0286	12.490	0.400	12.167	0.1204	0.0334	–						
2110	Moore-Sitterly	0.15	5.699	0.662	0.1649	0.0506	13.620	0.240	5.765	0.1894	0.0457	–						
2121	Sevastopol	0.15	9.318	0.933	0.2475	0.0543	12.480	0.290	9.337	0.2064	0.0448	S					S	Sl
2212	Hephaistos	0.15	5.536	0.555	0.1630	0.0423	13.525	0.230	5.636	0.2163	0.0460	SG	SG					
2478	Tokai	0.15	9.982	0.999	0.2084	0.0558	12.370	0.330	10.087	0.1957	0.0409	S		S			S	Sl
2486	Metsahovi	0.15	8.417	0.842	0.2321	0.0519	12.782	0.240	8.401	0.1929	0.0406	–						
2501	Lohja	0.15	11.822	1.184	0.1898	0.0581	12.155	0.234	11.843	0.1731	0.0353	A	A	A	A			
2544	Gubarev	0.15	9.261	0.970	0.2476	0.0565	12.350	0.240	9.308	0.2341	0.0550	–						
2642	Vesale	0.15	9.541	0.956	0.2044	0.0466	12.450	0.230	9.592	0.2010	0.0447	–						
2659	Millis	0.15	27.878	2.808	0.0498	0.0103	11.650	0.090	27.849	0.0498	0.0102	B		B				
2794	Kulik	0.15	7.622	0.767	0.1238	0.0350	13.480	0.230	7.647	0.1225	0.0289	–						
2815	Soma	0.15	7.158	0.721	0.3207	0.0762	12.980	0.240	7.067	0.2273	0.0490	S					S	S
2830	Greenwich	0.15	9.197	0.922	0.1846	0.0583	12.610	0.230	9.252	0.1865	0.0387	S	S					
2886	Tinkaping	0.15	5.784	0.581	0.2574	0.0559	13.280	0.230	5.825	0.2538	0.0565	–						
2897	Ole Romer	0.15	5.231	0.535	0.2827	0.0884	13.640	0.240	5.209	0.2278	0.0534	–						
2943	Heinrich	0.15	7.668	0.768	0.2295	0.0543	12.820	0.240	7.712	0.2212	0.0520	–						
2954	Delsemme	0.15	5.030	0.504	0.2590	0.0709	13.580	0.230	5.065	0.2547	0.0557	–						
3066	McFadden	0.15	14.805	1.481	0.2617	0.0928	11.240	0.230	14.896	0.2541	0.0546	SL					S	L
3116	Goodricke	0.15	7.856	0.793	0.2574	0.0580	12.620	0.230	7.909	0.2528	0.0540	S					S	Sl
3121	Tamines	0.15	6.059	0.620	0.2101	0.0694	13.460	0.300	6.107	0.1956	0.0428	S		S				
3122	Florence	0.15	4.401	0.441	0.2310	0.0673	14.515	0.266	4.349	0.1460	0.0330	S		S	Sqw			
3376	Armandhammer	0.15	8.168	0.823	0.2761	0.0657	12.540	0.240	8.199	0.2533	0.0536	S		Sq				
3554	Amun	0.15	3.332	0.340	0.0775	0.0261	15.870	0.260	3.337	0.0712	0.0154	–						
3576	Galina	0.15	7.802	0.784	0.1675	0.0456	13.200	0.240	7.815	0.1518	0.0345	S		Sl				
3673	Levy	0.15	6.412	0.661	0.2472	0.0592	13.140	0.280	6.468	0.2341	0.0515	–						
3691	Bede	0.15	1.803	0.209	0.5930	0.1687	15.220	0.430	1.827	0.4323	0.1084	Xc		Xc				
3752	Camillo	0.15	2.306	0.247	0.2100	0.0553	15.410	0.230	2.328	0.2234	0.0551	–						
3824	Brendalee	0.15	5.183	0.529	0.2570	0.0659	13.520	0.230	5.219	0.2534	0.0524	S		S				
3868	Mendoza	0.15	9.351	0.936	0.1621	0.0434	12.710	0.220	9.396	0.1649	0.0339	–						
3888	Hoyt	0.15	6.659	0.667	0.4011	0.1205	13.260	0.240	6.430	0.2122	0.0499	S					S	Sq
3896	Pordenone	0.15	20.001	2.003	0.1341	0.0287	11.610	0.240	19.930	0.1009	0.0225	–						
3918	Brel	0.15	6.262	0.639	0.2894	0.0607	13.030	0.240	6.299	0.2732	0.0586	–						
3928	Randa	0.15	5.733	0.599	0.2572	0.0647	13.650	0.240	5.686	0.1894	0.0538	–						
3982	Kastel’	0.15	6.790	0.770	0.2010	0.0508	13.350	0.510	6.901	0.1695	0.0407	–						
4029	Bridges	0.15	7.897	0.797	0.2063	0.0473	12.960	0.240	7.910	0.1848	0.0409	–						
4197	1982 TA	0.15	3.043	0.342	0.2760	0.0947	14.800	0.010	2.981	0.2389	0.0698	S		Sq	Sq			
4285	Hulkower	0.15	7.787	0.788	0.2092	0.0475	12.960	0.240	7.804	0.1898	0.0416	–						
4483	Petofi	0.15	5.545	0.555	0.2150	0.0718	13.570	0.420	5.653	0.2063	0.0432						X	X
4533	Orth	0.15	7.526	0.758	0.2369	0.0584	13.140	0.370	7.529	0.1728	0.0382	S					S	S
4555	1987 QL	0.15	3.126	0.332	0.3641	0.0958	14.280	0.300	3.174	0.3403	0.0808	–						
4638	Estens	0.15	4.595	0.612	0.2101	0.0746	13.950	0.240	4.635	0.2163	0.0596	–						
4666	Dietz	0.15	6.827	0.743	0.2391	0.0811	13.160	0.240	6.826	0.2064	0.0494						D	D
4674	Pauling	0.15	4.684	0.471	0.3872	0.1121	14.245	0.330	4.520	0.1733	0.0396	–						
4786	Tatianina	0.15	3.282	0.383	0.5136	0.1895	13.718	0.460	3.475	0.4763	0.1202	Xc		Xc				
4951	Iwamoto	0.15	5.515	0.552	0.1859	0.0493	13.740	0.190	5.528	0.1844	0.0387	S		S				
5080	Oja	0.15	8.377	0.844	0.1818	0.0505	13.010	0.240	8.377	0.1573	0.0333	–						
5129	Groom	0.15	8.189	0.826	0.2922	0.0774	13.060	0.160	7.974	0.1659	0.0373	–						
5143	Heracles	0.15	4.843	0.614	0.2270	0.0705	14.270	0.420	4.833	0.1481	0.0397	QVO		O	Q	V		
5313	Nunes	0.15	5.457	0.593	0.2839	0.0650	13.780	0.240	5.378	0.1878	0.0433	–						
5342	Le Poole	0.15	5.194	0.591	0.2607	0.0682	14.120	0.240	5.101	0.1527	0.0374	–						
5440	Terao	0.15	5.711	0.571	0.1814	0.0390	13.770	0.240	5.726	0.1673	0.0363	–						
5451	Plato	0.15	8.703	0.894	0.0534	0.0145	14.580	0.240	8.680	0.0345	0.0081	–						
5477	Holmes	0.15	3.147	0.343	0.3100	0.0727	14.445	0.390	3.215	0.2849	0.0657	–						
5484	Inoda	0.15	10.524	1.053	0.0944	0.0238	13.170	0.240	10.535	0.0859	0.0189	–						
5645	1990 SP	0.15	1.668	0.168	0.1210	0.0327	17.240	0.000	1.648	0.0827	0.0230	–						
5653	Camarillo	0.15	1.537	0.155	0.2710	0.0787	16.420	0.240	1.526	0.2052	0.0484	–						
5736	Sanford	0.15	5.060	0.517	0.2504	0.0610	14.170	0.240	4.981	0.1529	0.0402	–						
5905	Johnson	0.15	4.791	0.483	0.1939	0.0477	14.255	0.330	4.797	0.1524	0.0361	–						
5985	1942 RJ	0.15	6.212	0.672	0.1944	0.0467	13.530	0.240	6.225	0.1765	0.0409	–						
6084	Bascom	0.15	6.347	0.671	0.2197	0.0531	13.290	0.260	6.388	0.2091	0.0460	S					S	S
6178	1986 DA	0.15	3.199	0.381	0.1610	0.0468	15.900	0.200	3.149	0.0778	0.0203	–						
6185	1987 YD	0.15	9.930	0.996	0.0755	0.0180	13.480	0.240	9.947	0.0724	0.0157	–						
6361	1978 VL11	0.15	3.714	0.383	0.4099	0.1006	13.860	0.240	3.724	0.3639	0.0794	–						
6405	Komiyama	0.15	6.529	0.664	0.2626	0.0731	13.430	0.240	6.453	0.1801	0.0414	–						
6453	1991 NY	0.15	8.520	0.913	0.0883	0.0249	13.810	0.240	8.513	0.0729	0.0175	–						
6455	1992 HE	0.15	4.626	0.616	0.2270	0.0683	14.215	0.340	4.625	0.1701	0.0488	S		S	Srw			
6708	Bobbievaile	0.15	9.226	0.923	0.1031	0.0289	13.290	0.240	9.249	0.0997	0.0210	–						
6949	Zissell	0.15	8.184	0.820	0.0747	0.0158	14.000	0.240	8.187	0.0662	0.0153	–						
7020	Yourcenar	0.15	9.061	0.914	0.0712	0.0162	14.290	0.240	9.019	0.0418	0.0095	–						

Table 4 (*continued*)

Asteroid		*WISE*					*H*	*G*	Revised			Taxon.						
		G	*D* (km)	δD (km)	p_V	δp_V			*D* (km)	p_V	δp_V	(0)	(1)	(2)	(3)	(4)	(5)	(6)
7030	Colombini	0.15	6.529	0.810	0.0740	0.0168	14.480	0.240	6.533	0.0668	0.0177	–						
7033	1994 WN2	0.15	4.741	0.489	0.2184	0.0805	14.000	0.240	4.750	0.1966	0.0457	–						
7043	Godart	0.15	5.721	0.588	0.2250	0.0614	13.490	0.330	5.788	0.2118	0.0465	–						
7089	1992 FX1	0.15	5.011	0.504	0.3085	0.0673	14.050	0.240	4.898	0.1766	0.0385	–						
7116	Mentall	0.15	7.412	0.743	0.1524	0.0412	13.540	0.240	7.398	0.1238	0.0266	–						
7225	Huntress	0.15	6.680	0.705	0.1650	0.0368	13.490	0.360	6.748	0.1558	0.0342	S		S				
7229	Tonimoore	0.15	4.840	0.538	0.0434	0.0119	15.600	0.230	4.846	0.0433	0.0126	–						
7735	Scorzelli	0.15	6.719	0.688	0.4704	0.1194	13.100	0.120	6.371	0.2504	0.0703	–						
8033	1992 FY1	0.15	6.498	0.652	0.1581	0.0350	13.640	0.240	6.512	0.1457	0.0310	–						
8116	Jeanperrin	0.15	4.773	0.483	0.1859	0.0513	14.050	0.230	4.797	0.1841	0.0386	–						
8195	1993 UC1	0.15	8.137	0.831	0.2043	0.0456	12.900	0.240	8.152	0.1839	0.0412	–						
8338	Ralhan	0.15	4.791	0.523	0.3359	0.0978	14.020	0.240	4.680	0.1988	0.0465	–						
8356	Wadhwa	0.15	6.745	0.742	0.2945	0.1011	13.070	0.240	6.707	0.2323	0.0595	–						
9260	Edwardolson	0.15	4.115	0.548	0.2620	0.0641	14.540	0.240	4.052	0.1643	0.0459	–						
9556	Gaywray	0.15	6.587	0.662	0.2349	0.0721	13.710	0.240	6.482	0.1379	0.0384	–						
9617	Grahamchapman	0.15	2.840	0.476	0.2445	0.0627	14.970	0.240	2.849	0.2237	0.0770	–						
9782	Edo	0.15	6.012	0.612	0.2133	0.0476	13.480	0.240	6.031	0.1969	0.0446	–						
9948	1990 QB2	0.15	3.345	0.791	0.2502	0.1057	14.620	0.240	3.351	0.2232	0.1065	–						
10123	Fideoja	0.15	3.476	0.624	0.4414	0.1290	14.530	0.240	3.350	0.2426	0.0891	–						
10188	Yasuoyoneda	0.15	5.407	0.575	0.2193	0.0561	14.030	0.240	5.355	0.1505	0.0364	–						
10208	Germanicus	0.15	3.552	0.409	0.2667	0.0596	14.790	0.240	3.503	0.1747	0.0463	–						
10484	Hecht	0.15	4.623	0.720	0.2276	0.0756	14.180	0.240	4.601	0.1776	0.0580	–						
11072	Hiraoka	0.15	9.083	0.909	0.0853	0.0300	13.720	0.240	9.074	0.0697	0.0153	–						
11271	1988 KB	0.15	7.341	0.734	0.1980	0.0534	13.170	0.240	7.350	0.1764	0.0422	–						
11398	1998 YP11	0.15	1.316	0.373	0.3180	0.1143	16.590	0.290	1.310	0.2381	0.1357	–						
11500	Tomaiyowit	0.15	0.738	0.074	0.1420	0.0372	18.490	0.190	0.738	0.1304	0.0296	S		S				
12466	1997 AS12	0.15	4.701	0.537	0.1831	0.0453	14.210	0.240	4.709	0.1649	0.0406	–						
12923	Zephyr	0.15	2.060	0.206	0.1990	0.0523	15.930	0.240	2.062	0.1764	0.0379	–						
13144	1995 BJ	0.15	7.773	0.816	0.1682	0.0403	13.400	0.120	7.701	0.1300	0.0306	–						
13154	Petermrva	0.15	4.170	0.481	0.1523	0.0364	14.600	0.200	4.176	0.1464	0.0349	–						
15350	Naganuma	0.15	4.357	0.441	0.2563	0.0638	14.160	0.240	4.337	0.2035	0.0459	–						
15793	1993 TG19	0.15	3.497	0.990	0.1317	0.0953	15.460	0.240	3.482	0.0954	0.0570	–						
16064	1999 RH27	0.15	4.106	0.720	0.0200	0.0072	16.560	−0.140	4.100	0.0250	0.0089	–						
16115	1999 XH25	0.15	12.529	1.262	0.0710	0.0202	13.280	0.120	12.482	0.0553	0.0122	–						
16173	2000 AC98	0.15	3.879	0.407	0.2059	0.0583	14.430	0.270	3.905	0.1958	0.0427	–						
16403	1984 WJ1	0.15	4.147	0.430	0.3401	0.0707	13.740	0.370	4.238	0.3138	0.0683	–						
16691	1994 VS	0.15	2.671	0.659	0.2476	0.0668	15.010	0.240	2.690	0.2419	0.1280	–						
17060	Mikecombi	0.15	5.164	0.642	0.2405	0.0713	14.020	0.240	5.111	0.1667	0.0463	–						
17470	1991 BX	0.15	11.699	1.228	0.1177	0.0305	13.280	0.120	11.565	0.0644	0.0152	–						
17479	1991 PV9	0.15	6.352	0.766	0.2298	0.0707	13.640	0.240	6.286	0.1564	0.0393	–						
17938	Tamsendrew	0.15	3.224	0.344	0.2043	0.0530	14.870	0.240	3.235	0.1902	0.0461	–						
18096	2000 LM16	0.15	7.356	0.744	0.1185	0.0292	13.960	0.120	7.301	0.0864	0.0241	–						
18503	1996 PY4	0.15	3.529	0.356	0.4290	0.0920	14.510	0.240	3.408	0.2388	0.0598	–						
19763	Klimesh	0.15	7.270	0.740	0.1754	0.0582	13.270	0.240	7.291	0.1635	0.0389	–						
19764	2000 NF5	0.15	1.572	0.172	0.3420	0.1030	16.280	0.300	1.552	0.2256	0.0525	–						
20031	1992 OO	0.15	4.772	0.479	0.4481	0.1110	13.850	0.240	4.591	0.2417	0.0559	–						
20932	2258 T-1	0.15	5.234	0.610	0.3276	0.0840	13.780	0.240	5.132	0.2063	0.0507	–						
21088	1992 BL2	0.15	4.231	0.438	0.2060	0.0640	14.350	0.240	4.232	0.1794	0.0448	–						
21720	Pilishvili	0.15	3.163	0.350	0.2328	0.0515	15.140	0.240	3.130	0.1585	0.0368	–						
22166	2000 WX154	0.15	4.715	0.548	0.1995	0.0587	15.020	0.240	4.613	0.0815	0.0206	–						
23971	1998 YU9	0.15	8.152	0.821	0.0410	0.0083	14.570	0.120	8.146	0.0395	0.0086	–						
23979	1999 JL82	0.15	4.899	0.626	0.2930	0.0969	13.900	0.240	4.842	0.2075	0.0554	–						
24114	1999 VV23	0.15	4.967	0.525	0.4119	0.1013	13.520	0.240	4.880	0.2898	0.0709	–						
26045	1582 T-2	0.15	2.078	0.596	0.1959	0.0804	15.840	0.240	2.087	0.1871	0.1092	–						
26760	2001 KP41	0.15	5.400	0.657	0.0420	0.0131	15.580	0.050	5.387	0.0357	0.0095	–						
29168	1990 kJ	0.15	4.927	0.600	0.3483	0.0917	13.840	0.240	4.826	0.2207	0.0603	–						
29292	Conniewalker	0.15	4.581	0.507	0.3674	0.0880	13.590	0.240	4.571	0.3097	0.0761	–						
32953	1996 GF19	0.15	2.444	0.398	0.3897	0.1423	15.030	0.240	2.417	0.2942	0.0977	–						
34442	2000 SS64	0.15	4.992	0.505	0.1006	0.0221	14.540	0.120	4.994	0.1082	0.0230	–						
35389	1997 XO	0.15	4.345	0.517	0.1809	0.0623	14.690	0.120	4.291	0.1276	0.0333	–						
36492	2000 QW46	0.15	3.373	0.340	0.2461	0.0759	15.045	0.240	3.324	0.1534	0.0389	–						
40267	1999 GJ4	0.15	1.641	0.172	0.4530	0.1256	16.080	0.500	1.621	0.2487	0.0708	–						
42314	2001 VQ121	0.15	4.531	0.947	0.1971	0.1581	14.660	0.120	4.454	0.1218	0.0560	–						
45810	2000 QP32	0.15	2.304	0.385	0.4388	0.1209	15.320	0.240	2.234	0.2635	0.0924	–						
50822	2000 FH35	0.15	6.744	0.691	0.0740	0.0275	14.620	0.120	6.715	0.0556	0.0119	–						
51911	2001 QD68	0.15	12.304	1.238	0.0671	0.0198	13.520	0.120	12.246	0.0460	0.0099	–						
52762	1998 MT24	0.15	6.742	0.700	0.0510	0.0136	14.690	0.000	6.725	0.0520	0.0147	–						
62112	2000 RM99	0.15	5.331	0.598	0.2058	0.0526	13.880	0.120	5.288	0.1772	0.0429	–						
64588	2001 XX3	0.15	5.477	0.556	0.1950	0.0478	14.230	0.240	5.416	0.1224	0.0296	–						
66335	1999 JZ61	0.15	3.392	0.413	0.4637	0.1030	13.900	0.240	3.409	0.4186	0.1079	–						
68905	2002 JZ104	0.15	1.911	0.509	0.3668	0.2069	15.860	0.240	1.868	0.2293	0.1258	–						

(*continued on next page*)

Table 4 (*continued*)

Asteroid		*WISE*					*H*	*G*	Revised			Taxon.						
		G	*D* (km)	*δD* (km)	p_V	δp_V			*D* (km)	p_V	δp_V	(0)	(1)	(2)	(3)	(4)	(5)	(6)
71200	1999 XT236	0.15	6.610	0.677	0.0584	0.0169	14.885	0.120	6.589	0.0452	0.0106	–						
74355	1998 WJ12	0.15	4.469	0.587	0.1537	0.0795	14.760	0.240	4.446	0.1115	0.0316	–						
88188	2000 XH44	0.15	1.371	0.297	0.3740	0.1894	16.530	0.350	1.354	0.2356	0.1118	–						
88850	2001 SL222	0.15	3.377	0.857	0.0676	0.0503	15.630	0.120	3.387	0.0862	0.0442	–						
99475	2002 CR118	0.15	3.397	0.694	0.2916	0.1929	15.120	0.240	3.307	0.1446	0.0653	–						
100111	1993 FA51	0.15	6.098	0.641	0.0571	0.0145	15.040	0.120	6.082	0.0460	0.0109	–						
103067	1999 XA143	0.15	1.282	0.131	0.2460	0.0723	16.990	0.240	1.270	0.1751	0.0435	–						
105612	2000 RT99	0.15	5.507	0.641	0.1604	0.0445	14.450	0.240	5.454	0.0985	0.0240	–						
113846	2002 TV239	0.15	2.761	0.788	0.0638	0.0741	16.930	0.240	2.751	0.0395	0.0229	–						
139345	2001 KA67	0.15	3.101	0.340	0.0380	0.0110	17.060	0.240	3.097	0.0276	0.0074	–						
159669	2002 GY73	0.15	5.188	0.543	0.0498	0.0174	15.530	0.120	5.176	0.0405	0.0088	–						
206079	2002 RU66	0.15	3.987	0.922	0.1218	0.0497	15.120	0.120	3.965	0.1006	0.0477	–						
206400	2003 SW52	0.15	3.257	0.839	0.0418	0.0207	17.020	0.240	3.249	0.0260	0.0137	–						
232067	2001 UR220	0.15	4.750	0.595	0.0655	0.0202	15.340	0.120	4.740	0.0575	0.0151	–						
	2005 TQ27	0.15	3.969	0.421	0.0776	0.0222	15.690	0.120	3.952	0.0599	0.0171	–						

The *WISE* data were taken from http://wise2.ipac.caltech.edu/staff/bauer/NEOWISE_pass1/, file WISE_MBA_Pass1_Table_2011-09-16.txt, and from http://iopscience.iop.org/0004-637X/743/2/156/fulltext/, file apj408731t1_mrt.txt. For some objects that were observed at multiple epochs, they present each epoch as a separate row in their table; we use weighted means for *D* and p_V from the multiple entries, with the weights of ("dia_err")$^{-2}$ and ("pV_err")$^{-2}$, respectively, where "dia_err" and "pV_err" are their listed uncertainties for the individual entries. The uncertainties δD and δp_V given in the 3rd and 5th data columns are derived as quadratic sums of the formal uncertainties "dia_err" and "pV_err" (or their average for the multiple entries cases) from the *WISE* data files and the systematic errors of 0.1*D* and 0.2 p_V, respectively, as described in Section 4. The *H* and *G* data were taken from Table 2. The revised diameters and albedos and their uncertainties were made from the *WISE* estimates using the *H*, *G* data and applying the recalculation method of Harris and Harris (1997) as described in Section 4. The taxonomy data were taken from Tholen (1989), Bus and Binzel (2002), DeMeo et al. (2009), Xu et al. (1995), and Lazzaro et al. (2004), as compiled in Neese (2010); they are given in columns Taxon. (1)–(6) in the respective order (the last two columns are the data from Lazzaro et al. (2004), in the Tholen and the Bus&Binzel system, respectively). Column Taxon. (0) gives a "summary" of the taxonomic classifications; it is the union of capital letters from columns Taxon. (1)–(4) and the S/A/L classification from columns Taxon. (5) and (6).

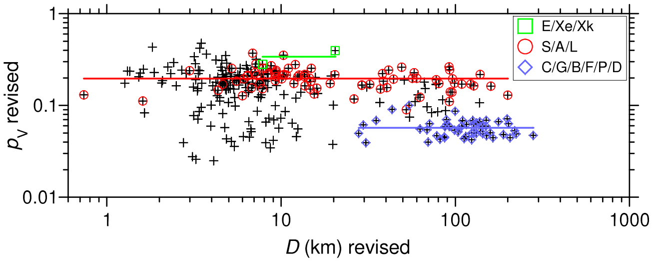

Fig. 10. The *WISE* albedos and diameters revised with the unbiased absolute magnitudes.

that many NEAs receive a substantial number of targeted follow-up observations, while small and faint main belt asteroids normally do not get any targeted follow-up and most or all their observations are by surveys only; targeted observations are potentially of a higher quality.

Also of interest is that the AstDyS *H* values are intrinsically more consistent (see their smaller scatter around the mean curves and fitted lines in Section 3), but slightly more biased than the MPCORB values. It seems that the magnitude correction/weighting scheme used at AstDyS does a good job in converting magnitude estimates by different stations to become a more homogeneous set, but it does not eliminate their overall bias.

6. Conclusions

We have shown that there is present a systematic offset of the orbit catalog *H* values in the sample of 583 objects measured carefully. We found that the apparent trend of increasing albedo with decreasing size seen for spectrally classified S type asteroids in the diameter range 5–30 km in the preliminary *WISE* albedos (Mainzer et al., 2011a) largely goes away when the corrected *H* values are used.

We mainly present this as a caution to others of the offset, and also the dispersion of wrong *H* values. It is beyond the scope of this paper to propose how one might apply this to correct the catalog values to be used, e.g., in modeling of data from a thermal survey of ten or hundred thousand asteroids. One might shift catalog *H* values by the mean offset we find, or increase the uncertainty estimate in *H* to include that offset.

We point out that what is ultimately needed is better photometric survey data so that derived catalog *H* values are more accurate. It appears to be a necessary and urgent task to re-examine the photometric reduction routines and methods of reporting magnitude estimates used by asteroid astrometric observers. Improvements on the side of orbit computers, e.g., use of more sophisticated magnitude correction and weighting schemes for estimating the *H* values, corresponding magnitude estimates reported by astrometric stations to accurate observations by photometric observers, could improve the situation partially. But improvements in measurement rather than subsequent data processing are always preferred. In particular, calibration using photometric star catalogs would be superior to using magnitudes given in most astrometric star catalogs. Since *H* values from orbit catalogs are often used for purposes like asteroid albedo estimation and magnitude–frequency distribution determination, it is strongly desired that they be much more accurate than they are now.

Acknowledgments

We thank to the reviewers Stephen Wolters and Amy Mainzer for their thorough reviews that led us to improve the paper in several points. The work was supported by the Grant Agency of the Czech Republic, Grants 205/09/1107 and P209/12/0229, and by Program RVO 67985815.

References

Bessell, M.S., 1990. UBVRI passbands. Publ. Astron. Soc. Pacific 102, 1181–1199.

Bowell, E., Hapke, B., Domingue, D., Lumme, K., Peltoniemi, J., Harris, A.W., 1989. Application of photometric models to asteroids. In: Asteroids II. Univ. Arizona Press, pp. 524–556.

Bus, S.J., Binzel, R.P., 2002. Phase II of the small main-belt asteroid spectroscopic survey: A feature-based taxonomy. Icarus 158, 146–177.

Dandy, C.L., Fitzsimmons, A., Collander-Brown, S.J., 2003. Optical colors of 56 near-Earth objects: Trends with size and orbit. Icarus 163, 363–373.

DeMeo, F.E., Binzel, R.P., Slivan, S.M., Bus, S.J., 2009. An extension of the Bus asteroid taxonomy into the near-infrared. Icarus 202, 160–180.

Drummond, J.D., Weidenschilling, S.J., Chapman, C.R., Davis, D.R., 1988. Photometric geodesy of main-belt asteroids. II – Analysis of lightcurves for poles, periods, and shapes. Icarus 76, 19–77.

Drummond, J.D., Weidenschilling, S.J., Chapman, C.R., Davis, D.R., 1991. Photometric geodesy of main-belt asteroids. IV – An updated analysis of lightcurves for poles, periods, and shapes. Icarus 89, 44–64.

Galád, A., 2010. Accuracy of calibrated data from the SDSS Moving Object Catalog, absolute magnitudes, and probable lightcurves for several asteroids. Astron. Astrophys. 514, A55–A64.

Harris, A.W., 1989. The H–G asteroid magnitude system: Mean slope parameters. Lunar Planet. Sci. Conf. Abstracts 20, 375.

Harris, A.W., Harris, A.W., 1997. On the revision of radiometric albedos and diameters of asteroids. Icarus 126, 450–454.

Harris, A.W., Young, J.W., 1989. Asteroid lightcurve observations from 1979–1981. Icarus 81, 314–364.

Harris, A.W. et al., 1989. Photoelectric observations of Asteroids 3, 24, 60, 261, and 863. Icarus 77, 171–186.

Harris, A.W., Young, J.W., Dockweiler, T., Gibson, J., Poutanen, M., Bowell, E., 1992. Asteroid lightcurve observations from 1981. Icarus 95, 115–147.

Harris, A.W., Young, J.W., Bowell, E., Tholen, D.J., 1999. Asteroid lightcurve observations from 1981 to 1983. Icarus 142, 173–201.

Jurić, M. et al., 2002. Comparison of positions and magnitudes of asteroids observed in the Sloan Digital Sky Survey with those predicted for known asteroids. Astron. J. 124, 1776–1787.

Landolt, A.U., 1973. UBV photoelectric sequences in the celestial equatorial selected areas 92–115. Astron. J. 78, 959–1021.

Landolt, A.U., 1983. UBVRI photometric standard stars around the celestial equator. Astron. J. 88, 439–460.

Landolt, A.U., 1992. UBVRI photometric standard stars in the magnitude range 11.5–16.0 around the celestial equator. Astron. J. 104, 340–371, 436–491.

Lazzaro, D., Angeli, C.A., Carvano, J.M., Mothé-Diniz, T., Duffard, R., Florczak, M., 2004. S^3OS^2: The visible spectroscopic survey of 820 asteroids. Icarus 172, 179–220.

Mainzer, A. et al., 2011a. NEOWISE studies of spectrophotometrically classified asteroids: Preliminary results. Astrophys. J. 741, 90–114.

Mainzer, A. et al., 2011b. NEOWISE observations of near-Earth objects: Preliminary results. Astrophys. J. 743, 156–172.

Masiero, J.R. et al., 2011. Main belt asteroids with WISE/NEOWISE. I: Preliminary albedos and diameters. Astrophys. J. 741, 68–89.

Neese, C., 2010. Asteroid Taxonomy V6.0. NASA Planetary Data System, EAR-A-5-DDR-TAXONOMY-V6.0.

Parker, A., Ivezić, Ž., Jurić, M., Lupton, R., Sekora, M.D., Kowalski, A., 2008. The size distributions of asteroid families in the SDSS Moving Object Catalog 4. Icarus 198, 138–155.

Pravec, P. et al., 2012. Binary asteroid population. 2: Anisotropic distribution of orbit poles of small, inner main-belt binaries. Icarus 218, 125–143.

Pravec, P., Harris, A.W., 2007. Binary asteroid population. 1: Angular momentum content. Icarus 190, 250–259.

Pravec, P., Šarounová, L., Wolf, M., 1996. Lightcurves of 7 near-Earth asteroids. Icarus 124, 471–482.

Pravec, P., Wolf, M., Šarounová, L., 1998. Lightcurves of 26 near-Earth asteroids. Icarus 136, 124–153.

Pravec, P. et al., 2000. Two-period lightcurves of 1996 FG3, 1998 PG, and (5407) 1992 AX: One probable and two possible binary asteroids. Icarus 146, 190–203.

Pravec, P. et al., 2006. Photometric survey of binary near-Earth asteroids. Icarus 181, 63–93.

Reddy, V. et al., 2007. (4951) Iwamoto. IAU Circ. 8836.

Romanishin, W., Tegler, S.C., 2005. Accurate absolute magnitudes for Kuiper belt objects and Centaurs. Icarus 179, 523–526.

Ryan, E.L., Woodward, C.E., 2011. Albedos of small Hilda group asteroids as revealed by Spitzer. Astron. J. 141, 186–195.

Shevchenko, V.G., Lupishko, D.F., 1998. Optical properties of asteroids from photometric data. Solar Syst. Res. 32, 220–232.

Tedesco, E.F., Noah, P.V., Noah, M., Price, S.D., 2002. The supplemental IRAS minor planet survey. Astron. J. 123, 1056–1085.

Tholen, D.J., 1984. Asteroid Taxonomy from Cluster Analysis of Photometry. Ph.D. Thesis, Arizona Univ., Tucson.

Tholen, D.J., 1989. Asteroid Taxonomic Classifications. In: Asteroids II, Univ. Arizona Press, pp. 1139–1150.

Usui, F. et al., 2011. Asteroid catalog using Akari: AKARI/IRC mid-infrared asteroid survey. Publ. Astron. Soc. Jpn. 63, 1117–1138.

Warner, B.D., Harris, A.W., Pravec, P., 2009. The asteroid lightcurve database. Icarus 202, 134–146.

Wisniewski, W.Z., Michałowski, T.M., Harris, A.W., McMillan, R.S., 1997. Photometric observations of 125 asteroids. Icarus 126, 395–449.

Xu, S., Binzel, R.P., Burbine, T.H., Bus, S.J., 1995. Small main-belt asteroid spectroscopic survey: Initial results. Icarus 115, 1–35.