PHOTOMETRY OF HIGH-ALBEDO ASTEROIDS IN OUTER ASTEROID BELT. O. I. Mikhalchenko[1,2], V. G. Shevchenko[1,2], I. G. Slyusarev[1,2], I. N. Belskaya[1,2], Yu. N. Krugly[1], V. G. Chiorny[1], A. N. Rublevsky[3], E. A. Sergeeva[3], K. A. Antonyuk[3], N. N. Kiselev[3], [1]Institute of Astronomy of V. N. Karazin Kharkiv National University, Sumska Str. 35, Kharkiv 61022, Ukraine, olgafantomsky@gmail.com, [2]Department of Astronomy and Space Informatics of V. N. Karazin Kharkiv National University, [3]Crimean Astrophysical Observatory

Introduction: It was traditionally believed that the outer part of the main belt asteroids is filled mostly with primitive low albedo asteroids. However, the albedo values obtained from the infrared surveys [1, 2] and estimation based on SDSS color indices and albedo [3] indicate a presence of moderate and high-albedo asteroids in the outer asteroid belt. However, it was pointed out in [4, 5] that SDSS color indices and radiometric albedos may have rather large observational errors. We initiated an observational photometric program to provide an independent check of the taxonomic type of selected outer-belt asteroids using their magnitude-phase dependences.

Observations: For our observational program we have chosen asteroids with orbital semimajor axis in the range of 2.99-3.39 AU, which belong to moderate/high albedo compositional classes or have albedos >0.1 according to the IRAS, WISE and AKARI IR-surveys [1, 2, 6]. New photometric observations of selected targets in order to measure their magnitude-phase dependences have been made for ten asteroids (see Table 1). The CCD photometry was carried out in the BVR bands mainly using the 0.7-m reflector of the Institute of Astronomy of V.N. Karazin Kharkiv National University in 2014-2018. The measured phase angle ranges of our observations are shown in Table 2.

Table 1. Physical characteristics of the observed asteroids

Asteroid number	Type [7,8]	D, km IRAS	p_V IRAS	D, km WISE	p_V WISE	D, km AKARI	p_V AKARI
152	D/S/A	-	-	59	0.24	57	0.26
325	M	76	0.11	-	-	76	0.1
665	X	51	0.39	-	-	53	0.36
692	S	46	0.18	43	0.2	45	0.18
723	C	36	0.18	-	-	28	0.29
745	-	-	-	25	0.2	23	0.25
768	X	-	-	33	0.14	31	0.17
1113	-	38	0.21	40	0.19	38	0.21
1175	-	-	-	24	0.25	23	0.3
1400	D	-	-	16	0.22	15	0.23

Table 2. Observational circumstances

Asteroid number	Observational period	Number of nights	Filters	Phase Angle min - max
152	Apr-Jun, 2017	12	VR	1.37 - 17.41
325	Sep-Nov, 2015	13	BVR	0.48 - 20.06
665	Jan-May, 2018	10	BVR	0.92 - 17.45
692	May-Jul, 2015	4	VR	10.64 - 17.08
723	Aug-Nov, 2014	17	VR	0.1 - 19.8
745	Jan-Mar, 2018	4	VR	2.84 - 17.48
768	Apr-Jun, 2016	9	R	3.57 - 16.14
1113	Aug-Nov, 2016	10	VR	2.13 - 18.99
1175	Apr-Aug, 2015	8	VR	3.83 - 16.94
1400	Jun-Jul, 2017	6	R	9.66 - 19.13

Preliminary results: For all observed asteroids, we have found that the brightness behavior as a function of the phase angle is similar to the S-type asteroids. Figure 1 demonstrates the resulting magnitude-phase dependences of (152) Atala and (723) Hammonia obtained during our observational program. There are some differences in the linear slopes of these asteroids. The phase curve of (152) Atala shows similarity to the phase curves measured for the Koronis family asteroids [12]. The phase curve of (723) Hammonia coincides well with the phase curves of S-type asteroids. It indicates that the asteroids (152) Atala and (723) Hammonia are most likely belong to the S-type asteroids. However, some differences in optical properties of their regolith layers may be present.

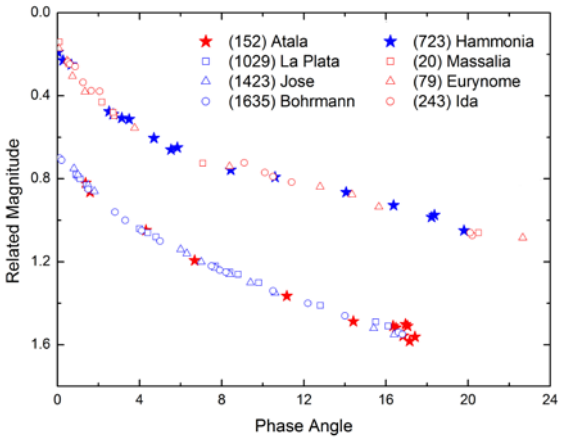

Figure 1. Magnitude-phase dependences of (152) Atala and (723) Hammonia. The magnitude-phase dependences of asteroids (20) Massalia [9], (79) Eurynome [10], (243) Ida [11], (1029) La Plata [12], (1423) Jose [12], and (1635) Bohrmann [12] are plotted for comparison.

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