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Multicolor Photometry of the Neptune Irregular Satellite Neso *

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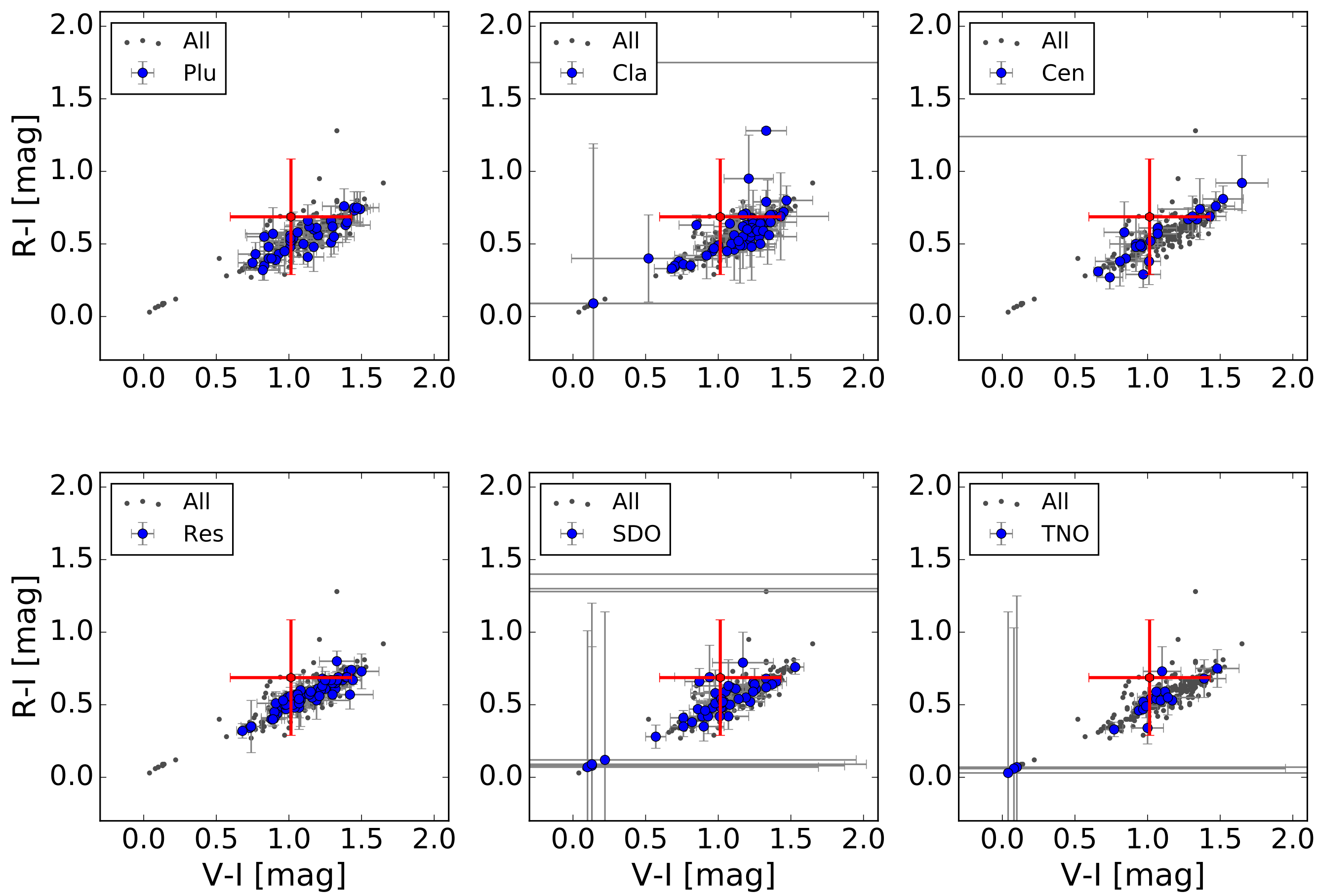

Figure 1. A comparison of the Neso colors from this work with solar system minor body classes from Peixinho, Delsanti, Doressoundiram (2015). In each frame Neso colors are marked in red and are compared with the colors of a single class from Peixinho, Delsanti, Doressoundiram (2015) represented by blue points, the gray points represents the other classes and are left as a reference. From left to right and from top to bottom: Plutinos (Plu), Classical KBOs (Cla), Centaurs (Cen), Resonant (Res), Scattered Disk Objects (SDO), Trans Neptuninan Objects (TNO). All the VRI photometry used to derived the average colors of Neso shown in red are listed in Tab. 1

We report on time series photometry of the faint Neptune irregular satellite Neso. Observations in the V, R, and I pass-bands were performed in photometric conditions at the Cerro Paranal observatory using the instrument FORS2. Photometric calibration was secured using observatory standards. Magnitudes were extracted using the IRAF task *qphot*, and corrected for aperture using bright stars in the field. Photometric errors have been derived extracting photometry of stars with magnitudes comparable to Neso, and were found to be around 0.3−0.4 mag. Astrometry is derived using up to 5 stars in the satellite vicinity basing on the astrometric catalog USNO-B1. We expect these data will be useful to better constrain the poorly known Neso orbit (Brozovic, Jacobson 2017). The time coverage is not sufficient to construct a light curve and derive a meaningful rotational period. However, we could derive new estimates of apparent magnitudes, in particular in V and I passbands, and for the first time we could calculate Neso colors. Arithmetic averages yields $V = 25.6 \pm 0.3$ from 12 exposures, $R = 25.2 \pm 0.2$ from 13 exposures, and $I = 24.5 \pm 0.3$ from from 25 exposures. The R averaged magnitude is in agreement with Brozovic, Jacobson, Sheppard (2011) who quote R=25.2, the only available measure to date. From these measures of the averaged magnitudes, we derive averaged colors. We obtain $V - I = 1.0 \pm 0.4$, $R - I = 0.7 \pm 0.4$, and $V - R = 0.3 \pm 0.4$, respectively. The color $R - I$ appear to be slightly redder than the typical values for Centaurs and KBOs as reported in Peixinho, Delsanti, Doressoundiram (2015), while the color $V-I$ is in nice agreement with both populations (see Fig. 1). Given the large error-bars in the averaged colors, it is a difficult task to assign Neso to any of the Peixinho, Delsanti, Doressoundiram (2015) classes, although the data seem to suggest that we can rule out its membership in classes of resonant objects or Plutinos.

Table 1. Astrometric and photomeric data for NESO, 2010 July 15

UT	RA(J2000.0)	Dec(J2000.0)	Filter	Airmass	Exp.Time (secs)	Mag
02:58:04.455	22:01:37.34	-12:26:34.87	R	1.920	600	25.4
03:08:40.521	22:01:37.26	-12:26:35.03	I	1.798	600	24.1
03:20:20.734	22:01:37.33	-12:26:34.51	V	1.683	600	25.2
03:31:03.481	22:01:37.19	-12:26:35.58	R	1.593	600	25.3
03:41:39.538	22:01:37.17	-12:26:35.82	I	1.551	300	24.8
03:47:05.577	22:01:37.14	-12:26:35.86	I	1.513	300	24.6
03:53:43.412	22:01:37.12	-12:26:35.96	V	1.439	600	25.5
04:04:26.449	22:01:37.08	-12:26:36.12	R	1.380	600	25.2
04:15:02.517	22:01:37.06	-12:26:36.27	I	1.352	300	25.1
04:20:30.705	22:01:37.03	-12:26:36.40	I	1.327	300	25.1
04:27:36.114	22:01:36.99	-12:26:36.69	V	1.276	600	25.7
04:38:18.511	22:01:36.95	-12:26:36.74	R	1.236	600	25.1
04:48:54.437	22:01:36.93	-12:26:36.93	I	1.217	300	24.3
04:54:23.057	22:01:36.91	-12:26:37.14	I	1.200	300	24.4
05:01:18.504	22:01:36.84	-12:26:40.47	V	1.166	600	25.4
05:12:01.492	22:01:36.82	-12:26:37.47	R	1.139	600	24.7
05:22:37.448	22:01:36.79	-12:26:37.52	I	1.127	300	24.3
05:28:05.997	22:01:36.78	-12:26:37.51	I	1.115	300	24.2
05:35:21.816	22:01:36.76	-12:26:37.61	V	1.093	600	25.1
05:46:04.414	22:01:36.71	-12:26:38.14	R	1.076	300	25.0
05:56:40.521	22:01:36.69	-12:26:38.28	I	1.068	300	24.8
06:02:08.589	22:01:36.67	-12:26:38.12	I	1.061	300	24.9
06:08:54.996	22:01:36.62	-12:26:38.75	V	1.048	600	25.3
06:19:37.303	22:01:36.59	-12:26:38.96	R	1.039	600	25.4
06:30:13.530	22:01:36.56	-12:26:39.23	I	1.035	300	24.2
06:35:41.979	22:01:36.54	-12:26:39.08	I	1.032	300	24.0
06:42:27.105	22:01:36.52	-12:26:39.25	V	1.026	600	25.8
06:53:09.383	22:01:36.46	-12:26:39.55	R	1.024	600	25.6
07:03:45.499	22:01:36.44	-12:26:39.77	I	1.023	300	23.8
07:09:13.988	22:01:36.42	-12:26:39.74	I	1.023	300	24.7
07:15:47.623	22:01:36.39	-12:26:40.03	V	1.025	600	25.5
07:26:30.371	22:01:36.36	-12:26:40.13	R	1.029	600	25.3
07:37:06.497	22:01:36.32	-12:26:40.43	I	1.031	300	24.5

Table 1 continued on next page

Table 1 *(continued)*

UT	RA(J2000.0)	Dec(J2000.0)	Filter	Airmass	Exp.Time (secs)	Mag
07:42:34.687	22:01:36.30	-12:26:40.45	I	1.035	300	24.5
07:49:14.322	22:01:36.28	-12:26:40.39	V	1.043	600	25.6
07:59:57.409	22:01:36.29	-12:26:40.59	R	1.054	600	25.1
08:10:33.617	22:01:36.21	-12:26:40.92	I	1.060	300	24.5
08:16:01.956	22:01:36.18	-12:26:41.10	I	1.067	300	24.5
08:22:41.182	22:01:36.15	-12:26:41.40	V	1.084	600	25.8
08:33:23.428	22:01:36.11	-12:26:41.45	R	1.102	600	25.1
08:43:59.605	22:01:36.10	-12:26:41.54	I	1.113	300	24.5
08:49:28.015	22:01:36.06	-12:26:41.43	I	1.124	300	24.8
08:56:06.490	22:01:36.03	-12:26:41.81	V	1.151	600	25.8
09:06:49.418	22:01:35.99	-12:26:42.20	R	1.179	600	25.3
09:17:25.754	22:01:35.97	-12:26:42.14	I	1.196	300	24.9
09:22:54.244	22:01:35.94	-12:26:42.55	I	1.213	300	24.7
09:29:31.409	22:01:35.92	-12:26:42.67	V	1.252	600	25.9
09:40:14.527	22:01:35.87	-12:26:42.90	R	1.294	600	25.4
09:50:50.793	22:01:35.84	-12:26:42.78	I	1.318	600	24.6
09:56:18.652	22:01:35.81	-12:26:43.17	I	1.343	600	24.6

Based on observations carried out at ESO Paranal under program 085.C-0187(C).

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