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Asteroidal *I, J, K* magnitudes recovered in the DENIS survey: Second release⋆

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Abstract. The DENIS programme (Deep European Near-Infrared Southern Sky Survey) has carried out a ground-based survey of the southern sky to provide an extensive *I*, *J*, *K* photometric catalog of point and extended sources. The limiting magnitudes of the three bands *I*, *J*, *K* centered at 0.8, 1.25 and 2.15 μm are respectively 18.5, 16.5 and 13.5. Given the short exposure time of the observations, asteroids have been included in the point source catalog as any other regular point-like object. We have searched the first 8000 asteroids on the basis of their predicted positions following a recognition procedure described previously (Baudrand et al. 2001); in this first release based on the DENIS data available in January 2001 we recovered 1233 asteroids. We present here the second release which provides 767 asteroids. Their *I*, *J*, *K* magnitudes are compiled in electronic tables available at the CDS.

Key words. infrared: solar system – minor planets, asteroids – surveys

1. Introduction

The DENIS programme, started in December 1995, has carried out a near-infrared survey dedicated to stars and galaxies. However, many asteroids were intercepted during the observations and included in the photometric IJK-catalog of point sources, which is one of the DENIS final products. In the DENIS data stream, the recognition of asteroid data was not trivial. A first release has already been published (Baudrand et al. 2001). To obtain it, we had to build an interface between the DENIS observations and the predicted positions of the asteroids. Since then, more data have been included in the point source catalog which allowed a second asteroidal release, described in this paper.

2. Description of the data

The DENIS obervational procedure was to scan the sky in strips of 30° of declination and 12′ of right ascension. The data reported here and summarized in Table 1 are the results of the search for the first 8000 asteroids among the 2513 new DENIS strips compiled in the database since January 2001.

Considering the multiple detections of the same object (38 doubles), 767 different asteroids were recovered and are compiled in three electronic tables with all the items described previously:

- the detections recovered in the three colors are reported in the electronic version of Table 2;
- the detections with missing colors are reported in the electronic version of Table 3 (only *I* and *J*) and Table 4 (only *I*).

Table 1. Number of asteroids detected one or two times and number of validated associations.

	One time	Two times	Associations
I only	183	8	191
I and *J* only	379	16	395
I, *J*, and *K*	205	14	219
Total	767	38	805

3. Reliability of the data

As noted in the previous paper, according to Fig. 1, asteroids color indexes are likely to range between the following boundaries:

$$0 < V_{\rm pred} - I < +1.5$$

$$+0.5 < V_{\rm pred} - J < +2$$

$$+1 < V_{\rm pred} - K < +3.$$

⋆ Tables 2–4 are only available in electronic form at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/cgi-bin/qcat?J/A+A/423/381

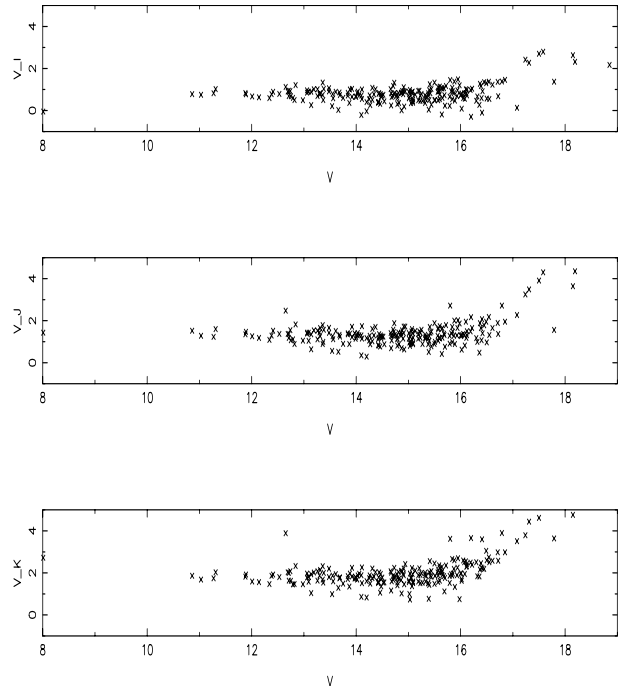

Fig. 1. The differences between predicted V magnitudes and observed I, J and K magnitudes for DENIS sources associated with known asteroids as functions of the predicted V magnitudes.

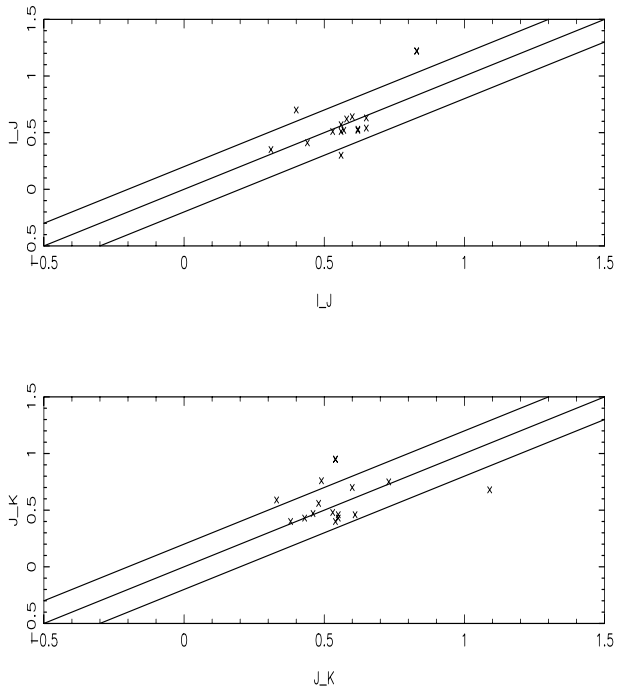

Fig. 2. Comparisons of the $J - K$ values and the $I - J$ values for the 14 asteroids observed by DENIS in the three bands on different dates.

Out of these ranges, the DENIS counter-part may result from the superposition of the asteroid and a background star. However, a large acceptance window is needed because of unknown color effects and uncertainties in absolute magnitudes.

As explained in the previous paper, internal comparisons are possible thanks to the detections at two different dates of 30 asteroids in I, J, K or only I, J.

They are presented in Figs. 2 and 3 which show good internal agreement, as most of the values fall inside the uncertainty boundaries. As previously, we note that the comparisons are satisfactory for asteroids observed in the three bands.

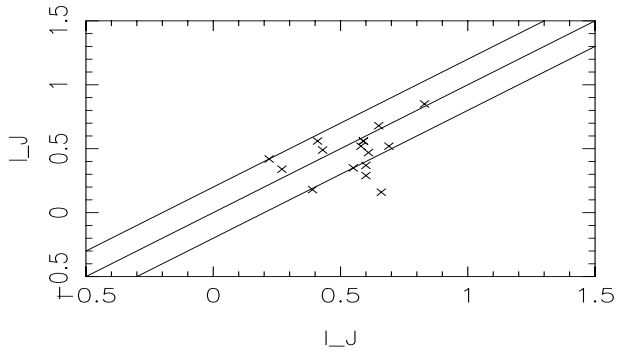

Fig. 3. Comparisons of the $I - J$ values for the 16 asteroids observed by DENIS in the I and J bands on different dates.

4. Comparisons between the first and second release

We have searched the asteroids observed in both releases. Among them, 15 different asteroids have been observed in the three wavelength bands, I, J and K; 41, in the I and J bands and 13 in the I band only. Figures 4 and 5 show the comparisons between the color indices $I - J$ and $J - K$. Note that some asteroids appear several times as they were observed twice or more in a same release.

5. Comparisons with other datasets

Most previous IR surveys of asteroids are centered in the three wavelength bands J, 1.25 μm, H, 1.65 μm and K, 2.17 μm, therefore, comparisons with the DENIS survey could be achieved only in J and K. The 2MASS survey (Cutri et al. 1999) provides an extensive *JHK* photometric catalog of stars and galaxies. It also released a large asteroid dataset (Sykes et al. 2000). 17 asteroids were commonly found in the 2MASS database and the DENIS second release. The comparisons of their $J - K$ colors are satisfactory as shown in Fig. 6.

Six other *JHK* datasets (Chapman & Morrison 1976; Veeder et al. 1982, 1983; Hahn & Lagerkvist 1988; Smith et al. 1992; Veeder et al. 1995) were used for comparison with the DENIS second release. Figure 7 shows a good agreement for the 16 objects found in common.

6. Conclusion

In this second release, we have found 805 associations of asteroids with DENIS sources out of which 767 different asteroids have been identified among the 8000 first asteroids. In the first release, we observed 1233 different asteroids. Considering the 69 asteroids recovered in the two releases, we now have data available for 1931 different asteroids. More precisely, data are available in the three wavelength bands I, J, K, for 472 asteroids (282 asteroids in the first release, 205 in the second

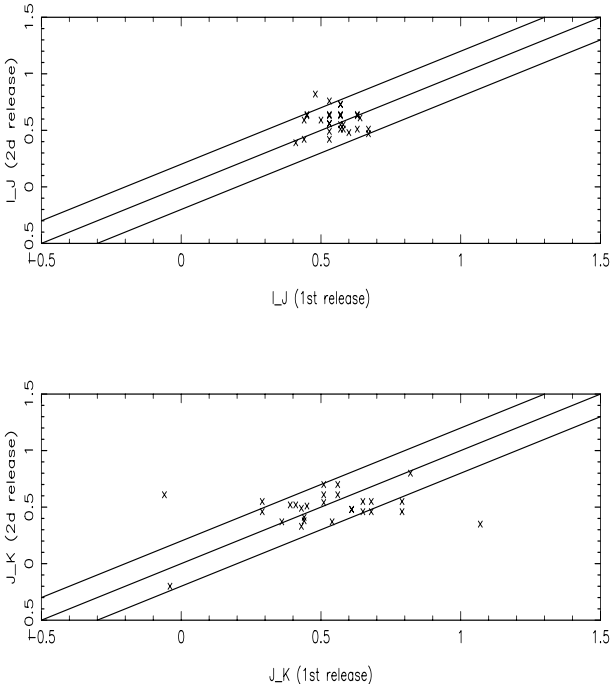

Fig. 4. Comparisons of the $J-K$ values and the $I-J$ values for the asteroids observed in the first and second release by DENIS.

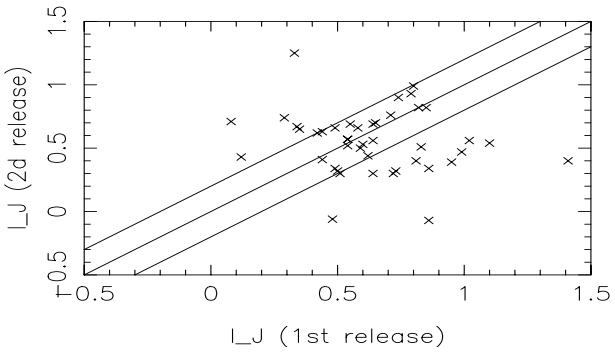

Fig. 5. Comparisons of the $I-J$ values for the asteroids observed in the first and second release by DENIS, only in two bands.

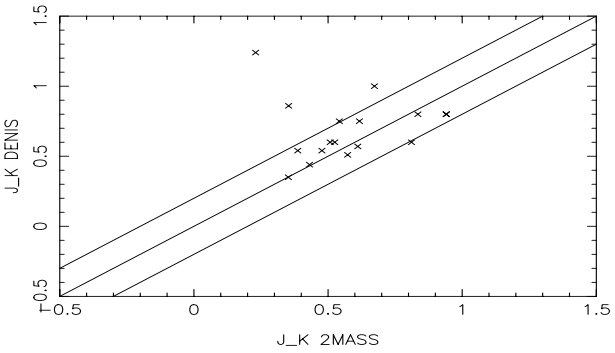

Fig. 6. $J-K$ comparisons of 17 objects commonly found in 2MASS database and the DENIS second release.

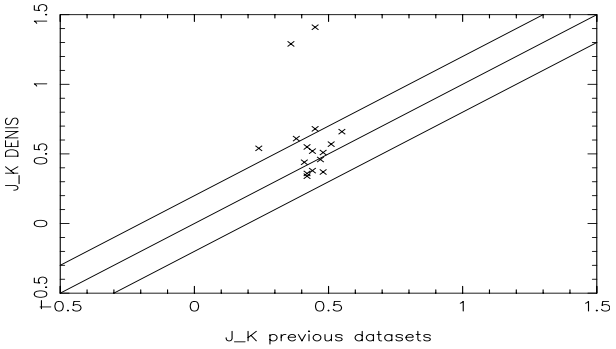

Fig. 7. $J-K$ comparisons of 16 objects commonly found in the DENIS second release and six previous *JHK* asteroid datasets.

and 15 in the two releases). This number is significant with regard to the size of the previous asteroid surveys.

Most of the previous near-infrared surveys give J, H, K data. Therefore, the DENIS data in I, J, K are important as they will allow connections with data in the visible wavelengths.

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