

# Astrometry of minor planets made at the Skalnaté Pleso Observatory in the year 2004

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**Abstract.** The paper presents the results of position determinations of minor planets carried out at the Skalnaté Pleso Observatory in the year 2004. 38 CCD observations of 7 minor planets are given together with the list of reference stars.

**Key words:** astrometry – asteroids

## 1. Introduction

The presented paper is a continuation of the previous papers which gave the results of positional CCD observations of minor planets obtained at the Skalnaté Pleso Observatory (the last paper of this series: Neslušan, 2005) and contains the observations made in the year 2004.

The reference stars were selected from the USNO-A2.0 Star Catalog (Monet et al., 1998).

The reduction was made using the method of plate constants within computer program *Astrometrica* (Raab, 1993).

A total of 38 accurate positions of 7 minor planets are given. A list of reference stars and a list of collaborators are included, too. The list of collaborators informs about their share in exposing, measuring, and reducing the positions.

## 2. Positions of minor planets

The data have been arranged according to serial numbers of minor planets. The individual columns of the table contain the following:

N – serial number of observation,

MP – number of minor planet (if unnumbered, yet, the preliminary designation is given in parentheses),

Date U.T. – date and time of the middle of the exposure,

$R.A._{2000}$  – right ascension for equinox 2000.0 (in h,m,s),

$Decl._{2000}$  – declination for equinox 2000.0 (in  $^{\circ}$ ,  $'$ ,  $''$ ),

$d\alpha$  – the mean residual in R.A. in arc seconds,

$d\delta$  – the mean residual in Decl. in arc seconds.

| N  | MP          | Date U.T. | $R.A._{2000}$ | $Decl._{2000}$ | $d\alpha$   | $d\delta$ |
|----|-------------|-----------|---------------|----------------|-------------|-----------|
| 1  | 1095        | 2004 Feb. | 25.95816      | 08 26 43.07    | +09 09 04.7 | 0.1 0.1   |
| 2  | 1095        | 2004 Feb. | 25.96651      | 08 26 42.78    | +09 09 07.3 | 0.1 0.2   |
| 3  | 25529       | 2004 Jan. | 12.71586      | 00 44 18.12    | +08 45 07.5 | 0.1 0.1   |
| 4  | 25529       | 2004 Jan. | 12.72654      | 00 44 19.04    | +08 45 15.8 | 0.0 0.2   |
| 5  | 31843       | 2004 Apr. | 21.95064      | 16 06 02.09    | +12 00 08.0 | 0.3 0.1   |
| 6  | 31843       | 2004 Apr. | 21.96248      | 16 06 01.96    | +12 00 24.1 | 0.2 0.2   |
| 7  | 31843       | 2004 Jun. | 15.93529      | 15 35 31.24    | +23 05 35.3 | 0.2 0.3   |
| 8  | 31843       | 2004 Jun. | 15.95290      | 15 35 30.83    | +23 05 29.7 | 0.1 0.1   |
| 9  | 31843       | 2004 Jun. | 21.86826      | 15 34 10.99    | +22 31 24.0 | 0.2 0.3   |
| 10 | 31843       | 2004 Jun. | 21.87855      | 15 34 10.96    | +22 31 18.7 | 0.3 0.1   |
| 11 | 31843       | 2004 Jul. | 4.83358       | 15 35 42.65    | +20 16 18.4 | 0.2 0.3   |
| 12 | 31843       | 2004 Jul. | 4.84287       | 15 35 42.53    | +20 16 05.1 | 0.2 0.2   |
| 13 | 34943       | 2004 Apr. | 22.00222      | 15 34 28.12    | -04 33 01.5 | 0.1 0.2   |
| 14 | 34943       | 2004 Apr. | 22.01328      | 15 34 27.65    | -04 32 55.5 | 0.2 0.2   |
| 15 | 34943       | 2004 Apr. | 26.87389      | 15 31 40.44    | -03 40 22.5 | 0.2 0.3   |
| 16 | 34943       | 2004 Apr. | 26.89039      | 15 31 39.83    | -03 40 11.2 | 0.1 0.1   |
| 17 | 43584       | 2004 Apr. | 21.83888      | 12 34 18.34    | +02 18 46.8 | 0.1 0.1   |
| 18 | 43584       | 2004 Apr. | 21.84733      | 12 34 17.99    | +02 18 55.9 | 0.1 0.1   |
| 19 | 43584       | 2004 Apr. | 26.84415      | 12 31 39.68    | +03 49 02.4 | 0.3 0.2   |
| 20 | 43584       | 2004 Apr. | 26.85676      | 12 31 39.37    | +03 49 13.8 | 0.2 0.1   |
| 21 | 43584       | 2004 May  | 10.86160      | 12 27 58.66    | +07 12 53.9 | 0.1 0.1   |
| 22 | 43584       | 2004 May  | 10.87435      | 12 27 58.64    | +07 13 03.1 | 0.1 0.2   |
| 23 | 43584       | 2004 Jun. | 15.89596      | 12 46 16.26    | +10 09 24.5 | 0.2 0.0   |
| 24 | 43584       | 2004 Jun. | 15.89992      | 12 46 16.54    | +10 09 24.9 | 0.1 0.1   |
| 25 | 43584       | 2004 Jun. | 15.90818      | 12 46 16.96    | +10 09 24.6 | 0.2 0.3   |
| 26 | 43584       | 2004 Jun. | 21.85068      | 12 52 40.08    | +09 59 26.2 | 0.2 0.0   |
| 27 | 43584       | 2004 Jun. | 21.86009      | 12 52 41.32    | +09 59 38.9 | 0.2 0.1   |
| 28 | (2001 XU10) | 2004 Jan. | 12.69888      | 04 34 27.74    | +68 22 19.8 | 0.2 0.1   |
| 29 | (2001 XU10) | 2004 Jan. | 12.70586      | 04 34 27.33    | +68 22 05.5 | 0.2 0.1   |
| 30 | (2003 YT1)  | 2004 Apr. | 14.88337      | 22 44 47.24    | +66 31 31.1 | 0.2 0.3   |
| 31 | (2003 YT1)  | 2004 Apr. | 14.89094      | 22 44 49.14    | +66 31 59.4 | 0.2 0.3   |
| 32 | (2003 YT1)  | 2004 Apr. | 14.89788      | 22 44 50.87    | +66 32 25.7 | 0.2 0.3   |
| 33 | (2003 YT1)  | 2004 Apr. | 15.85639      | 22 48 51.30    | +67 34 12.2 | 0.2 0.1   |
| 34 | (2003 YT1)  | 2004 Apr. | 15.86429      | 22 48 53.75    | +67 34 44.4 | 0.2 0.0   |
| 35 | (2003 YT1)  | 2004 Apr. | 20.94837      | 23 42 48.95    | +75 06 19.4 | 0.1 0.2   |
| 36 | (2003 YT1)  | 2004 Apr. | 20.95618      | 23 42 59.30    | +75 07 12.2 | 0.3 0.1   |
| 37 | (2003 YT1)  | 2004 Apr. | 21.90204      | 00 07 21.14    | +76 55 18.1 | 0.1 0.1   |
| 38 | (2003 YT1)  | 2004 Apr. | 21.90920      | 00 07 23.03    | +76 55 28.8 | 0.1 0.1   |

### 3. Reference stars

The individual columns of the table contain the following:

N – serial number of the observation in agreement with the Section 2,

Numbers of reference stars in the USNO-A2.0 Star Catalog,

$\Delta\alpha$  – the O–C difference in R.A. in arc seconds,

$\Delta\delta$  – the O–C difference in Decl. in arc seconds.

The position of each reference star in the field of other reference stars is determined within the used method of plate constants.  $\Delta\alpha$  and  $\Delta\delta$  are the differences between observed (O) and calculated (C) coordinates. Except of a common measurement error, these differences are caused by an inaccuracy of position of a given star in the catalog and by the time shift between the catalog and considered epochs.

| N | Number of star  | $\Delta\alpha$ | $\Delta\delta$ | Number of star  | $\Delta\alpha$ | $\Delta\delta$ |
|---|-----------------|----------------|----------------|-----------------|----------------|----------------|
| 1 | A 0975.05899541 | +0.0           | +0.2           | A 0975.05898063 | -0.0           | -0.2           |
|   | A 0975.05894507 | -0.1           | -0.1           | A 0975.05894493 | +0.1           | +0.2           |
|   | A 0975.05897499 | -0.0           | -0.1           | A 0975.05899926 | +0.0           | +0.0           |
| 2 | A 0975.05899541 | +0.1           | +0.3           | A 0975.05898063 | -0.1           | -0.3           |
|   | A 0975.05894507 | -0.1           | +0.2           | A 0975.05894493 | +0.1           | -0.1           |
|   | A 0975.05897499 | -0.1           | +0.0           | A 0975.05899926 | +0.0           | -0.1           |
| 3 | A 0975.00156466 | -0.0           | -0.1           | A 0975.00156266 | +0.0           | -0.1           |
|   | A 0975.00155663 | -0.0           | +0.2           | A 0975.00155446 | -0.1           | +0.3           |
|   | A 0975.00155426 | +0.1           | -0.3           | A 0975.00155166 | +0.2           | -0.0           |
|   | A 0975.00154797 | -0.1           | -0.1           |                 |                |                |
| 4 | A 0975.00156466 | -0.0           | -0.1           | A 0975.00156266 | -0.0           | -0.1           |
|   | A 0975.00155663 | +0.1           | +0.2           | A 0975.00155446 | +0.0           | +0.4           |
|   | A 0975.00155426 | -0.0           | -0.3           | A 0975.00155166 | +0.1           | -0.0           |
|   | A 0975.00154797 | -0.1           | -0.1           |                 |                |                |
| 5 | A 0975.08137724 | -0.3           | +0.1           | A 0975.08133286 | +0.2           | +0.0           |
|   | A 0975.08134343 | -0.0           | +0.1           | A 0975.08134844 | +0.2           | -0.1           |
|   | A 0975.08137642 | -0.5           | +0.1           | A 0975.08139095 | +0.4           | -0.1           |
|   | A 0975.08139339 | +0.4           | +0.2           | A 0975.08137342 | -0.3           | -0.4           |
| 6 | A 0975.08137724 | -0.1           | +0.3           | A 0975.08133286 | +0.1           | -0.1           |
|   | A 0975.08134343 | -0.2           | +0.3           | A 0975.08134844 | +0.3           | -0.1           |
|   | A 0975.08137642 | -0.5           | -0.0           | A 0975.08139095 | +0.5           | +0.1           |
|   | A 0975.08137342 | -0.1           | -0.3           | A 0975.08137726 | -0.0           | -0.1           |
| 7 | A 1125.07318416 | -0.2           | +0.5           | A 1125.07318364 | -0.4           | +0.3           |
|   | A 1125.07318183 | +0.4           | -0.4           | A 1125.07313976 | +0.1           | -0.1           |
|   | A 1125.07313123 | -0.2           | +0.2           | A 1125.07314248 | +0.1           | +0.0           |
|   | A 1125.07316782 | +0.2           | -0.5           |                 |                |                |
| 8 | A 1125.07317388 | -0.2           | -0.1           | A 1125.07318898 | +0.3           | +0.1           |
|   | A 1125.07318183 | -0.2           | -0.1           | A 1125.07313471 | +0.0           | +0.0           |
|   | A 1125.07313123 | +0.1           | +0.0           |                 |                |                |

| N  | Number of star  | $\Delta\alpha$ | $\Delta\delta$ | Number of star  | $\Delta\alpha$ | $\Delta\delta$ |
|----|-----------------|----------------|----------------|-----------------|----------------|----------------|
| 9  | A 1125.07309851 | -0.1           | +0.3           | A 1125.07310161 | +0.2           | -0.3           |
|    | A 1050.07548266 | -0.2           | +0.2           | A 1125.07306954 | +0.4           | -0.4           |
|    | A 1125.07307353 | -0.4           | +0.1           | A 1125.07308307 | +0.2           | +0.4           |
|    | A 1125.07309577 | -0.1           | -0.4           | A 1125.07309334 | +0.1           | +0.1           |
| 10 | A 1125.07309851 | +0.1           | +0.0           | A 1125.07310161 | +0.1           | -0.2           |
|    | A 1050.07548266 | -0.2           | +0.2           | A 1125.07306954 | +0.3           | -0.4           |
|    | A 1125.07308307 | +0.3           | +0.1           | A 1125.07309577 | -0.5           | -0.1           |
|    | A 1125.07309334 | +0.3           | +0.1           | A 1125.07306402 | -0.3           | +0.2           |
| 11 | A 1050.07558825 | +0.1           | +0.3           | A 1050.07559472 | -0.2           | -0.4           |
|    | A 1050.07555902 | +0.3           | +0.2           | A 1050.07556019 | -0.3           | -0.1           |
|    | A 1050.07556195 | -0.1           | -0.3           | A 1050.07557867 | +0.1           | +0.3           |
| 12 | A 1050.07558825 | +0.1           | +0.3           | A 1050.07559472 | -0.1           | -0.4           |
|    | A 1050.07555902 | +0.4           | +0.1           | A 1050.07556019 | -0.5           | +0.0           |
|    | A 1050.07556195 | +0.0           | -0.3           | A 1050.07557867 | +0.1           | +0.3           |
| 13 | A 0825.08811863 | +0.5           | +0.2           | A 0825.08810453 | -0.3           | -0.4           |
|    | A 0825.08808205 | +0.1           | +0.2           | A 0825.08810075 | -0.1           | -0.2           |
|    | A 0825.08812715 | -0.1           | +0.1           | A 0825.08813065 | -0.1           | -0.1           |
|    | A 0825.08806870 | +0.0           | -0.1           | A 0825.08808285 | +0.0           | +0.3           |
| 14 | A 0825.08811863 | +0.5           | -0.0           | A 0825.08808205 | -0.2           | +0.3           |
|    | A 0825.08810075 | -0.0           | -0.4           | A 0825.08812715 | -0.3           | +0.4           |
|    | A 0825.08813065 | -0.1           | -0.2           | A 0825.08806870 | +0.0           | -0.1           |
|    | A 0825.08808285 | +0.0           | +0.3           | A 0825.08808766 | +0.1           | -0.2           |
| 15 | A 0825.08790550 | -0.2           | -0.1           | A 0825.08788031 | +0.1           | +0.6           |
|    | A 0825.08783282 | +0.3           | -0.2           | A 0825.08788555 | +0.0           | +0.0           |
|    | A 0825.08786898 | +0.1           | -0.5           | A 0825.08783169 | -0.4           | +0.3           |
| 16 | A 0825.08790550 | +0.0           | +0.0           | A 0825.08783282 | -0.2           | -0.2           |
|    | A 0825.08788555 | -0.1           | -0.1           | A 0825.08786898 | -0.0           | -0.0           |
|    | A 0825.08785181 | +0.3           | +0.3           |                 |                |                |
| 17 | A 0900.07182583 | +0.1           | +0.1           | A 0900.07182055 | +0.1           | +0.1           |
|    | A 0900.07180868 | -0.1           | -0.1           | A 0900.07183850 | -0.1           | -0.1           |
|    | A 0900.07184804 | -0.0           | -0.0           |                 |                |                |
| 18 | A 0900.07182583 | +0.1           | +0.1           | A 0900.07182055 | +0.3           | -0.2           |
|    | A 0900.07180868 | -0.2           | +0.0           | A 0900.07183850 | -0.1           | -0.0           |
|    | A 0900.07184804 | -0.0           | +0.0           | A 0900.07182230 | -0.1           | +0.1           |
| 19 | A 0900.07172885 | +0.2           | +0.2           | A 0900.07171415 | +0.4           | +0.2           |
|    | A 0900.07171739 | -0.3           | -0.0           | A 0900.07173336 | +0.2           | +0.1           |
|    | A 0900.07170966 | +0.0           | +0.1           | A 0900.07172422 | -0.5           | -0.6           |
| 20 | A 0900.07172885 | +0.0           | +0.1           | A 0900.07171415 | +0.5           | +0.1           |
|    | A 0900.07173336 | +0.2           | +0.1           | A 0900.07170966 | -0.0           | +0.0           |
|    | A 0900.07172422 | -0.1           | -0.3           | A 0900.07171829 | -0.6           | -0.1           |
| 21 | A 0900.07159230 | -0.0           | +0.2           | A 0900.07156436 | -0.1           | +0.1           |
|    | A 0900.07157415 | -0.0           | -0.2           | A 0900.07158489 | -0.0           | +0.1           |
|    | A 0900.07158633 | +0.1           | -0.1           | A 0900.07158527 | +0.0           | -0.2           |
|    | A 0900.07155938 | +0.1           | +0.1           |                 |                |                |

| N  | Number of star  | $\Delta\alpha$ | $\Delta\delta$ | Number of star  | $\Delta\alpha$ | $\Delta\delta$ |
|----|-----------------|----------------|----------------|-----------------|----------------|----------------|
| 22 | A 0900.07159230 | -0.0           | +0.3           | A 0900.07156436 | -0.1           | +0.1           |
|    | A 0900.07157415 | -0.0           | -0.2           | A 0900.07158489 | +0.1           | +0.2           |
|    | A 0900.07158633 | -0.0           | -0.2           | A 0900.07158527 | +0.0           | -0.3           |
|    | A 0900.07155938 | +0.1           | +0.1           |                 |                |                |
| 23 | A 0975.07027254 | +0.2           | +0.1           | A 0975.07027241 | -0.1           | -0.0           |
|    | A 0975.07030311 | -0.3           | -0.0           | A 0975.07030006 | +0.2           | +0.0           |
|    | A 0975.07030590 | +0.1           | +0.0           | A 0975.07026927 | -0.1           | -0.0           |
| 24 | A 0975.07027254 | +0.2           | -0.0           | A 0975.07027241 | -0.1           | +0.0           |
|    | A 0975.07030311 | -0.2           | -0.1           | A 0975.07030006 | +0.1           | +0.1           |
|    | A 0975.07030590 | +0.1           | +0.0           | A 0975.07026927 | -0.1           | +0.0           |
| 25 | A 0975.07027254 | +0.2           | +0.8           | A 0975.07027241 | -0.1           | -0.5           |
|    | A 0975.07030311 | -0.4           | +0.1           | A 0975.07030006 | +0.2           | -0.0           |
|    | A 0975.07030590 | +0.1           | -0.1           | A 0975.07026927 | -0.1           | -0.3           |
| 26 | A 0975.07057113 | -0.1           | -0.0           | A 0975.07055613 | +0.3           | +0.0           |
|    | A 0975.07055018 | -0.5           | -0.1           | A 0975.07054800 | +0.3           | +0.0           |
|    | A 0975.07056174 | -0.1           | +0.0           | A 0975.07057316 | +0.1           | -0.0           |
| 27 | A 0975.07057113 | -0.1           | -0.0           | A 0975.07055613 | +0.3           | +0.1           |
|    | A 0975.07055018 | -0.5           | -0.2           | A 0975.07054800 | +0.2           | +0.0           |
|    | A 0975.07056174 | -0.0           | +0.1           | A 0975.07057316 | +0.0           | -0.0           |
| 28 | A 1575.02073420 | +0.2           | +0.1           | A 1575.02072037 | +0.0           | -0.1           |
|    | A 1575.02069689 | -0.2           | +0.1           | A 1575.02064360 | +0.2           | +0.0           |
|    | A 1575.02066285 | +0.4           | -0.1           | A 1575.02068727 | -0.1           | -0.1           |
|    | A 1575.02066237 | -0.3           | +0.2           | A 1575.02067783 | -0.3           | -0.1           |
| 29 | A 1575.02073420 | +0.2           | +0.1           | A 1575.02072037 | +0.0           | -0.1           |
|    | A 1575.02069689 | -0.2           | +0.2           | A 1575.02064360 | +0.2           | +0.0           |
|    | A 1575.02066285 | +0.4           | -0.2           | A 1575.02068727 | -0.1           | -0.2           |
|    | A 1575.02066237 | -0.2           | +0.3           | A 1575.02067783 | -0.4           | -0.1           |
| 30 | A 1500.09271512 | +0.2           | -0.3           | A 1500.09279378 | -0.3           | +0.4           |
|    | A 1500.09293480 | +0.3           | -0.4           | A 1500.09301418 | -0.3           | +0.0           |
|    | A 1500.09301085 | +0.0           | +0.4           | A 1500.09300600 | +0.2           | -0.3           |
|    | A 1500.09276585 | -0.1           | +0.2           |                 |                |                |
| 31 | A 1500.09271512 | +0.2           | -0.3           | A 1500.09279378 | -0.3           | +0.4           |
|    | A 1500.09293480 | +0.3           | -0.4           | A 1500.09301418 | -0.3           | +0.1           |
|    | A 1500.09301085 | -0.1           | +0.5           | A 1500.09300600 | +0.3           | -0.4           |
|    | A 1500.09276585 | -0.1           | +0.1           |                 |                |                |
| 32 | A 1500.09271512 | +0.2           | -0.3           | A 1500.09279378 | -0.2           | +0.3           |
|    | A 1500.09293480 | +0.3           | -0.4           | A 1500.09301418 | -0.3           | +0.1           |
|    | A 1500.09301085 | -0.1           | +0.3           | A 1500.09300600 | +0.2           | -0.3           |
|    | A 1500.09276585 | -0.1           | +0.1           |                 |                |                |
| 33 | A 1575.05282985 | -0.2           | -0.1           | A 1575.05285293 | +0.5           | -0.0           |
|    | A 1575.05288095 | -0.3           | +0.1           | A 1575.05289420 | +0.2           | +0.0           |
|    | A 1575.05284939 | -0.1           | -0.0           | A 1575.05278019 | +0.1           | +0.0           |
|    | A 1575.05282799 | -0.1           | +0.0           | A 1575.05275870 | -0.0           | +0.0           |
| 34 | A 1575.05282985 | -0.2           | -0.1           | A 1575.05285293 | +0.5           | +0.0           |
|    | A 1575.05288095 | -0.3           | -0.0           | A 1575.05289420 | +0.2           | +0.0           |
|    | A 1575.05284939 | -0.2           | +0.0           | A 1575.05278019 | +0.1           | +0.0           |
|    | A 1575.05282799 | -0.2           | +0.0           | A 1575.05275870 | +0.0           | -0.0           |

| N  | Number of star  | $\Delta\alpha$ | $\Delta\delta$ | Number of star  | $\Delta\alpha$ | $\Delta\delta$ |
|----|-----------------|----------------|----------------|-----------------|----------------|----------------|
| 35 | A 1650.02830290 | +0.0           | +0.1           | A 1650.02836067 | +0.1           | -0.0           |
|    | A 1650.02836779 | -0.2           | -0.0           | A 1650.02838852 | +0.1           | +0.1           |
|    | A 1650.02837610 | +0.2           | +0.3           | A 1650.02835437 | -0.4           | -0.3           |
| 36 | A 1650.02833062 | +0.2           | -0.4           | A 1650.02831346 | -0.0           | +0.3           |
|    | A 1650.02830290 | -0.4           | -0.2           | A 1650.02837610 | +0.5           | +0.2           |
|    | A 1650.02839215 | -0.3           | -0.2           | A 1575.05773696 | +0.1           | +0.1           |
|    | A 1650.02825321 | +0.0           | -0.1           | A 1650.02825387 | -0.3           | +0.1           |
| 37 | A 1650.02825713 | +0.5           | +0.1           |                 |                |                |
|    | A 1650.00022028 | +0.1           | -0.1           | A 1650.00025041 | -0.0           | +0.1           |
|    | A 1650.00027962 | -0.1           | +0.2           | A 1650.00033117 | +0.1           | -0.1           |
|    | A 1650.00028884 | -0.1           | -0.2           | A 1650.00027254 | +0.0           | +0.1           |
| 38 | A 1650.00023145 | -0.1           | -0.1           |                 |                |                |
|    | A 1650.00022028 | +0.0           | -0.1           | A 1650.00025041 | -0.1           | +0.1           |
|    | A 1650.00027962 | +0.2           | +0.2           | A 1650.00033117 | -0.1           | -0.1           |
|    | A 1650.00028884 | -0.1           | -0.2           | A 1650.00027254 | +0.1           | +0.1           |
|    | A 1650.00023145 | -0.1           | -0.1           |                 |                |                |

#### 4. List of collaborators

| Name          | Exposures | Measurements | Reductions |
|---------------|-----------|--------------|------------|
| G. Červák     | 3         | 4            | –          |
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| M. Jakubík    | 3         | 3            | –          |
| Z. Kaňuchová  | 1         | 1            | –          |
| L. Neslušan   | 7         | 6            | 38         |
| P. Rychtarčík | 17        | 18           | –          |

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#### References

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