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SUMMARY In the course of our attempts to organize a European Near-Earth Object (NEO) search program, we have started a project to perform photometric observations of known and/or newly discovered NEOs. The purpose of this program is to determine important physical parameters, such as rotation period and spin axis orientation, and to get information on the asteroid's shape and color using lightcurve data obtained by photoelectric and/or CCD broadband photometry. Coordination of the observations through cooperation between groups at different observatories has been established, allowing rapid exchange of preliminary results obtained from a nearly real-time data reduction procedure. In this way individual objects can be observed with the proper sampling rate depending on their estimated speed of rotation, optimizing the use of available telescope time. The photometric reduction routine, developed at the DLR, allows also the determination of accurate astrometric positions from suitably selected CCD frames, containing a sufficient number of GSC reference stars.

INTRODUCTION Massive NEO survey programs are proposed and planned for the near future [1,2]. The rapidly increasing number of new discoveries urges also intensified observing programs in order to determine the basic physical parameters of NEOs, classify them and select particularly interesting ones for further scrutiny. Photometric lightcurve measurements allow the determination of the rotation period, the spin axis orientation, and give us information on the overall shape of the object. Broadband color data can be used for surface classification and give an indication of the mineralogical properties. We recently initiated a project which is aimed at monitoring NEOs on a long-term basis, by observing both objects for which the orbits are already well established, and, as target of opportunity, objects which are newly discovered. The goal is to use observational techniques, mainly CCD photometry and astrometry, to contribute to the build-up of a data base of physical properties of NEOs, and to the determination and/or improvement of their orbital parameters.

This poster reports the results of the project obtained through summer 1994. We obtained lightcurve parameters for eight NEOs and two Mars crossers, for most of which we also derived astrometric positions. Preliminary results from the latest campaign in December 1994 are presented as well.

OBSERVATIONS, INSTRUMENTATION AND DATA REDUCTION The main goal of this first series of observations was to test the suitability of various site/telescope/instrumentation combinations and to develop observing strategies suited to the usually fast-moving NEOs. Observations were performed at ESO, La Silla, Chile (ESO 1-m, Dutch 90-cm, and Bochum 61-cm telescope with both CCD cameras and standard photometer) and in Sweden (Kvistaberg 1-m Schmidt telescope with CCD camera). All measurements were made in the Johnson V or R band and with standard stars taken from [3,4,5].

Different observing strategies have been explored in order to maximize the scientific return. In particular the use of differential photometry at poorer observing sites has proved to be fully satisfactory, allowing to derive rotational periods and amplitudes even under moderate weather conditions. Furthermore, the use of a large-area CCD allowed us to measure astrometric positions on the photometric frames, by using astrometric standard stars from the Guide Star Catalog [6] present in the same field as the asteroid. Particular care has been paid during the planning and realization of the observations in order to avoid any observational bias that could favourably select asteroids with short rotational periods and large amplitudes. The reduction of the photoelectric measurements was performed using the ESO software SNOPY. All CCD observations were reduced by ASTPHOT, a synthetic aperture photometry package developed at DLR. Whenever possible, astrometric positions were also determined with the software and reported to the Minor Planet Center. A detailed description of this project and its results is published elsewhere [7].

In Table 1, which summarizes our results obtained through summer 1994, orbit classification is taken
Table 1: Results

<table>
<thead>
<tr>
<th>Asteroid</th>
<th>Orbit type</th>
<th>$H$ (mag)</th>
<th>Diameter (km)</th>
<th>Period (hr)</th>
<th>maximum amplitude (mas)</th>
<th>quality code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981 Midas</td>
<td>Apollo</td>
<td>15.18 ± 0.05</td>
<td>3.5</td>
<td>5.220 ± 0.006</td>
<td>0.65 ± 0.02</td>
<td>3</td>
</tr>
<tr>
<td>2062 Aten</td>
<td>Aten</td>
<td>17.12 ± 0.05</td>
<td>1.1</td>
<td>40.77 ± 0.20</td>
<td>0.26 ± 0.02</td>
<td>2</td>
</tr>
<tr>
<td>4953 1990 $MU$</td>
<td>Apollo</td>
<td>15.10 ± 0.05</td>
<td>3.6</td>
<td>14.218 ± 0.053</td>
<td>0.68 ± 0.02</td>
<td>3</td>
</tr>
<tr>
<td>5653 1992 $WD_5$</td>
<td>Amor</td>
<td>4.8341 ± 0.0060</td>
<td>0.85 ± 0.02</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5797 1980 $AA$</td>
<td>Amor</td>
<td>2.706 ± 0.003</td>
<td>0.17 ± 0.02</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>5836 1993 $MF$</td>
<td>Amor</td>
<td>15.03 ± 0.05</td>
<td>3.8</td>
<td>4.959 ± 0.023</td>
<td>0.76 ± 0.02</td>
<td>3</td>
</tr>
<tr>
<td>1993 $BX_3$</td>
<td>Apollo</td>
<td>20.78 ± 0.05</td>
<td>0.3</td>
<td>20.463 ± 0.070</td>
<td>&gt; 0.40</td>
<td>2</td>
</tr>
<tr>
<td>1994 $AW_1$</td>
<td>Amor</td>
<td>17.61 ± 0.05</td>
<td>1.1</td>
<td>&gt; 0.40</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>1994 $JF_1$</td>
<td>MC</td>
<td>17.22 ± 0.05</td>
<td>1.4</td>
<td>50.6 ± 0.2</td>
<td>&gt; 0.40</td>
<td>2</td>
</tr>
<tr>
<td>1994 $LC_1$</td>
<td>MC</td>
<td>16.68 ± 0.05</td>
<td>1.8</td>
<td>2.4058 ± 0.0006</td>
<td>0.13 ± 0.02</td>
<td>3</td>
</tr>
</tbody>
</table>

from [8]. The absolute magnitude $H$ has been calculated by assuming a nominal value $G=0.15$ except for
(2062) Aten were we assumed $G=0.22$ based on the known taxonomic type. The diameter of the asteroid
has been estimated by using an albedo $p=0.20$ for (2062) and $p=0.125$ for the others. The last column gives
the quality code of the period as defined in [9].

During November and December 1994, coordinated observing campaigns have been organized, using
the 60cm Bochum telescope at ESO and the 65cm reflector equipped with a SBIG ST-6 CCD camera at
the Ondřejov observatory [10,11]. The purpose of this exercise was to enlarge the lightcurve coverage of
asteroids which are observable from both sides, either during the same night, or by follow-up observations,
responding to preliminary analysis of the observations communicated via electronic mail. In this way it is,
e.g., possible to almost double the observing time for an asteroid located at the celestial equator: 6.5 hours
+ the difference in longitudes between the stations (5.7 hours between La Silla and Ondřejov). Four NEO
have been observed during this campaigns: 1989 VA, 1992 TC, (2102) Tantalus and (5751) 1992 AC, and
the results will be shown at the poster presentation of the meeting.

In the future this kind of observing program will be continued and possibly extended to include more
stations for coordinated campaigns, e.g. Kharkov Astronomical Observatory in the Ukraine, which would
enlarge the potential observing time during a single night to almost 14 hours.