The Calar Alto Serendipitous Asteroid Discovery and Observation program — CASADO

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In the past years much effort was put into programs for asteroid discovery. Large-scale programs like LINEAR[1] and Catalina Sky Survey were introduced and powerful telescopes like Pan-STARRS[3] were built only for the purpose of finding asteroids, to name just a few. Thus, the rate of asteroid discoveries literally exploded. Although by far the largest number of observations is done by the big surveys also smaller observation programs can provide valuable data. Telescopes, whether they hunt asteroids or do other tasks, image them all the time. By searching the images for serendipitously observed asteroids one can contribute to refine orbits of already known asteroids, find new objects and sometimes even determine basic physical properties which are unknown for most of the known asteroids.

In October 2012 we started CASADO, a program for secondary usage of the data collected within a long term observation program carried out at the 1.23m telescope at Calar Alto. The telescope is equipped with a 4k by 4k CCD covering a field of view of about 22 by 22 arcmin. We use the telescope for 100 nights per year mainly for photometric observations of Jupiter Trojans[4] but also main-belt objects, satellites of Jupiter and comets are sometimes observed. In a typical observation campaign, we focus on about 15 to 20 minor bodies of which we repetitively observe 10 to 15 during a single night.

To search the fields for serendipitously-observed objects we implemented a semi-automated software which performs the astrometric calibration, searches the images for moving objects, identifies already known asteroids and prepares MPC reports. By calculating preliminary orbital elements for the newly-discovered objects using OpenOrb[2] we are also able to compute ephemeris and reliably link the observations of these objects over multiple nights. Not only do we process the images of ongoing campaigns, but also went back in time to July 2011. While the astrometry of the objects which have been found is reported to the Minor Planet Center we also look for asteroids imaged over several nights to combine the observations to lightcurves. As of March 2014, CASADO, which also serves the purpose of educating and training young students and observers, has obtained 151 provisional designations assigned by the MPC. Among them 2013 SA_{87}, according to the MPC the only TNO discovered in 2013. Form the carefully-selected candidate objects for lightcurve analysis we were able to determine 9 reliable rotational periods.

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