Reviving astrometry on the McDonald observatory 2.1-m Otto Struve telescope

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The first regular observations of asteroids at McDonald observatory started in 1950 with a 10-inch telescope as part of the Yerkes–McDonald survey, which was followed by a long lull after its completion in 1952. Astrometric observations resumed in the early 70s using the 2.1-m telescope, but were mainly of faint outer solar system satellites to support the emerging planetary space program. Observation of asteroids was later added to the program in order to refine the fundamental reference frame and to aid Hubble Space Telescope astrometry. Near-Earth Objects (NEOs) have been the main emphasis since 1995 using a 0.76 m telescope, which worked very well while the surveys concentrated on objects 1 km or larger. However, NASA's mission to discover and catalogue NEOs has been extended down to objects 140 m in size. Most of these new NEO candidates are outside the reach of the 0.76-m telescope. In 2011, the Otto Struve telescope has received a new instrument, the Camera for QUasars in EArly uNiverse, or CQUEAN (Park, 2012). The telescope-camera combination allows us to follow up virtually any object discovered by the various NEO search teams, as it provides measurable images of a 19th magnitude source with a single 10 second exposure in the red. The field of view is 4.8' by 4.8', with 0.281 arcsec/pixel resolution, and we can fully sample the point-spread function for precision astrometry. Although this telescope is 75 years old, we are getting circular stellar images for exposures up to 240 seconds with the CQUEAN auto-guider. We obtained images of M71 at three different air masses during two nights in the Sloan i and r filter bands. The σ of the standard coordinate residuals is a little under 0.07 seconds of arc for both cases. We have also looked at the field of view for systematic errors both in direction and magnitude, and we found it to be satisfactorily uniform. The overall quality of our data is improved due to better angular resolution and dome seeing. Based on the statistics of the residuals provided by the Minor Planet Center, 95 % of our new data has residual less than 1 second of arc with respect to the best fitting orbits compared to 75 % for our earlier observations.

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