PDC2015
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IAA-PDC-15-02-02

DESIGN CHARACTERISTICS OF AN OPTIMIZED GROUND BASED NEO SURVEY TELESCOPE

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Keywords: *asteroids, Near-Earth Objects, survey*

ABSTRACT

Ground based optical telescopes currently used to find and track Near-Earth Objects (NEOs) were originally designed for other astronomical applications and therefore not necessarily optimized to detect faint moving transients. A “next-generation” optimized NEO survey telescope system capable of satisfying the goal of finding 90% of the population of potentially hazardous asteroids within a decade or two needs to be optically fast to reduce the effects of trailing loss, have a wide field of view, be capable of providing good images over the full angular field of the detector array, and be capable of reaching limiting magnitude of V~24 in a reasonable integration time. Other system attributes, such as detector architecture, pixel and array size, array gaps, slew/settle times, and post-acquisition reduction and analysis software, as well as extrinsic attributes such as astronomical seeing and seasonal faction of clear nights at the site must be factored into quantifying survey efficiency.

We have investigated existing, planned, and optimized NEO survey telescopes using one, two, three and four mirror optical designs to identify the best balance of performance and cost. The most interesting options are presented and include a cluster of 2-m class prime focus telescopes used together; a single ~4-m class prime

focus telescope and a ~4-m scaled-down LSST design. We find that it is practical to consider f/1.3 prime focus systems with corrected fields of ~4 degrees diameter using no, or very wide band filters. A single mirror, prime focus camera design makes best use of optical photon collecting area because of a minimal central obscuration.

One to half arc second pixels provide sufficient image resolution at good observatory sites, but monolithic, gap-free detector arrays are currently limited to the 10.5K x 10.5K STA1600 CCD that inscribes the standard 15cm silicon wafer. However, it should be possible to develop an array that better fills out the wafer. Future monolithic arrays may utilize a 20cm wafer, but the development time scale, driven by demand, will be some time off. The more immediate need is for 2- or 3-side buttable devices. For now, the readout time of the STA 1600 with 16 readout channels appropriately matches the field-to-field move/settle time for most telescopes.

A quantitative modeling tool to compare the relative performance of these designs is described in the poster by Christensen et al.

This work is supported by the NASA Near Earth Objects Observation program.