Introduction

The Harvard College Observatory plate collection consists of approximately 530,000 photographs produced by over 80 telescopes spanning over 100 years from about 1895 to the 1992. The goal of the Digital Access to a Sky Century @ Harvard (DASCH) project is to digitize this entire collection and provide photometry measurements for all images. With the successful completion of a high speed plate digitizer we have digitized over 10,000 plates. The analysis of this digitized data presents a number of challenges that we are no longer encountering with modern CCD photographic techniques. One of these challenges is to extract accurate photometric and astrometric data from multiple exposure plates.

Multiple Image Plates

Superposition of two fields to calibrate stars in Cygnus with the North Polar Sequence. See the Multiple Exposure Loop for more details.

Extension of dynamic range using nine exposures with each successive exposure half the duration of the preceeding exposure.

Ghost images produced by a Pickering or Racine Wedge. See the Pickering Wedge section for more details.

Low dispersion images produced by a coarse grating placed in front of the telescope objective. The geometry of the grating determines the relative brightness of the images.

Number of Multiple Exposure Plates

Logbook transcription has been completed for only 40% of the collection to date. These transcriptions show that approximately 2.6%, or over 13,000 plates, are multiple exposures. Coarse gratings are less frequent with only 100 known grating plates. Unfortunately, the logbooks make no systematic mention of the use of Pickering Wedges.

The DASCH Data Processing Pipeline and Multiple Exposure Plate Processing

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The DASCH Database

Implemented primarily as MySQL tables.

Contains digitized logbook entries for determining exposure date.

Tracks the scanning and photometric pipeline workflow.

Contains plate WCS parameters to allow searches for plates containing given objects.

Binary files allow rapid retrieval of lightcurves with a spatial index consisting of 1/4096 square degree rectangles aligned to RA and Declination coordinates. Currently contains 10^9 magnitudes, including measurements of 43x10^6 GSC2.3 catalog stars.

References

M Servillat “Correcting the Astrometry of DASCH Scanned Plates”, A companion paper presented at this ADASS conference.

The Pickering Wedge Filter

The Pickering Wedge is a low-dispersion prism placed near the telescope objective to create ghost images for more accurate photometry when the primary images saturate. A spatial correlation technique described below allows identification of Pickering Wedge ghost images. We discovered that this technique works well for ghost images believed to have been caused by misaligned telescope optics. Although not currently implemented, this filter combined with the multiple exposure loop could process grating images.

The Multiple Exposure Loop

To find multiple exposures, rerun the pipeline with any unmatched images.

If an image from one exposure overlaps an image from another exposure, flag the two different catalog matches as “blended” if the total catalog flux changes the brightness by more than 0.1 mag

After the last exposure has been found, any remaining unmatched images always have an uncertain exposure date.

Abort the loop if the new plate center is too close to previously known plate centers.

The DASCH Project

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Visit the DASCH website at http://hea-www.harvard.edu/DASCH