The NOAO Science Archive: Public Access to zBoötes and FSVS

Christopher J. Miller

The deployment of the NOAO Science Archive (NSA) was announced on 9 April 2002. At that time, the NSA contained data from three NOAO Surveys: the NOAO Deep Wide-Field Survey (NDWFS), the Resolved Stellar Content of the Local Group Survey, and the Deep Range Survey. Since then, the number of survey holdings has quadrupled, growing from ~2,000 FITs images to nearly 70,000 images (68,992 to be exact). This major growth can be attributed to both the efforts of the Survey Principal Investigators (PIs), who have provided the reduced, science-quality images, and the hard work of the NOAO Data Products Program (DPP) archive team.

We are pleased to announce the latest additions to the NSA: the Faint Sky Variability Survey (FSVS) and zBootes.

The FSVS provides data over 23 square degrees at moderate-to-high galactic latitudes for studying faint stellar populations and their variability. Spanning magnitudes 16-24 across the optical regime using the B, V, and I filters, it also has V-band time-domain data over tens of minutes to years. Jan van Paradijs (University of Amsterdam) and Steve Howell (NOAO) are Co-PIs on this NOAO Survey. For more information on the FSVS data products, see Groot et al., 2003 *MNRAS*, 339, 427.

zBoötes is a z-band survey of the NDWFS Boötes Field using the Steward Observatory 2.3-meter Bok telescope and the 90Prime imager. The zBoötes imaging covers 7.62 square degrees of the NDWFS (which is itself ~9 square degrees). It reaches a mean 50 percent completeness limit of magnitude 22.8 in the z-band. Richard Cool (University of Arizona) is the PI, and you can find more information is his recent article, Cool, 2007 *ApJS*, 169, 21.

The NSA also provides science-quality imaging data for the Deep Lens Survey (Tyson et al.), the Fundamental Plane Peculiar Velocity Survey of Rich Clusters (Hudson et al.), Deep Imaging of Nearby Star-Forming Clouds (Bally et al.), Star Formation in HI-Selected Galaxies (Meurer et al.), A Next Generation Microlensing Survey of the LMC (Stubbs et al.), the w Project: Measuring the Equation of State of the Universe (Suntzeff et al.), the Deep Ecliptic Survey (Millis et al.), ChaMPlane: Measuring the Faint X-ray Binary and Stellar Content of the Galaxy (Grindlay et al.), the First Look Survey (Soifer et al.), and FLAMEX DR1 in the Boötes (Elston and Gonzalez et al.).

Check out the growing NOAO Science Archive at *archive.noao.edu/nsa/*.

The NOAO High-Performance Pipeline

Frank Valdes, Christopher J. Miller & The Pipeline Group

For several years, NOAO has had a project to build a high-performance pipeline system, as well as pipeline applications, for the NOAO Mosaic imagers and the NEWFIRM wide-field infrared imager. The three key goals of the pipeline project are to provide Principal Investigators (PIs) with calibrated data quickly after their observations, to provide the community with well-characterized and easy-to-use wide-field imaging data once it becomes public, and to provide NOAO instrument scientists with the ability to monitor data quality.

The pipeline infrastructure is an event-driven, multi-process parallel system based on simultaneous processing of data chunks. Astronomical imaging datasets are well suited to this type of parallelization. The technical details of the pipeline are described in the proceedings of ADASS 2006 (not yet published) and are currently located online at *chive.tuc.noao.edu/noaodpp/Pipeline/PL001.pdf*.

In the near future, PIs will be able to download pipeline-processed Mosaic and NEWFIRM datasets. NOAO Science Archive users will also be able to obtain data under the NOAO proprietary data policy as the pipeline populates the archive.

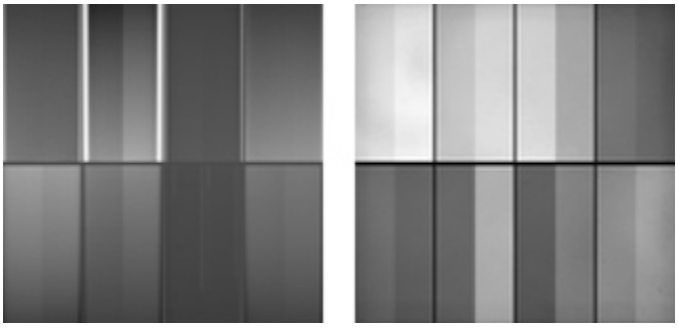

Figure 1: Combined zero-frames and dome flats automatically created for Mosaic-2 data from CTIO.

The Mosaic pipeline applies standard image-reduction techniques, including bias corrections, flat-field corrections (see figure 1), fringe and pupil-ghost removal, astrometric calibrations, and data quality characterization, such as photometric depth and image quality. As a pipeline for general PI programs, this is an automated process with

continued

NOAO High Performance Pipeline continued

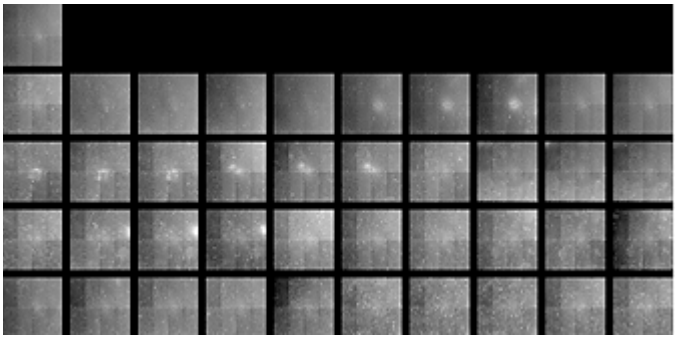

Figure 2: A sequence of Mosaic-2 science frames taken around the time of a PI observing run. These are analyzed and culled to create a final list to combine into a sky flat.

many challenges. For instance, the selection of images needed for dark-sky flat fields must be done entirely automatically (see figure 2).

The current Mosaic pipeline provides the user with two primary data products: the individual calibrated CCD images, and a re-sampled single mosaic of the CCD focal-plane in a standard orientation (see figure 3). We show an example from the CTIO Mosaic-2 camera of the combined zeros and dome flats, and the transformation of a raw image into the primary data products, as well as the data characterization (e.g., the photometric depth).

The NEWFIRM pipeline is now in development. It will provide quick reductions for observers at the telescope and final calibrated data for PIs. It will also provide the traditional detector calibrations and perform the necessary sky subtraction and stacking needed to reduce the dominance of the infrared sky.

The NOAO Mosaic pipeline is entering its Science Verification phase. Future goals of the pipeline project include stacked and mosaicked images from sets of dithered images for NEWFIRM as well as for Mosaic, plus catalogs and variable alerts. Staff from NOAO Data Products Program (DPP) will be asking some Mosaic PIs to help evaluate the reductions in comparison to their own, and for ideas on how to improve the calibrations for greater scientific quality.

The full release of the pipeline reductions to the general astronomical community will occur after this Science Verification process. We would very much appreciate your interest and your support in this endeavor. We believe that an NOAO archive containing well-characterized, pipeline-reduced Mosaic and NEWFIRM imaging data will be an invaluable resource for the astronomical community.

Contributors to the NOAO DPP pipeline include many current and former staff members at NOAO and the University of Maryland, including F. Valdes, R. Swaters, D. Scott, F. Pierfederici, B. Thomas, M. Miller, and M. Dickinson.

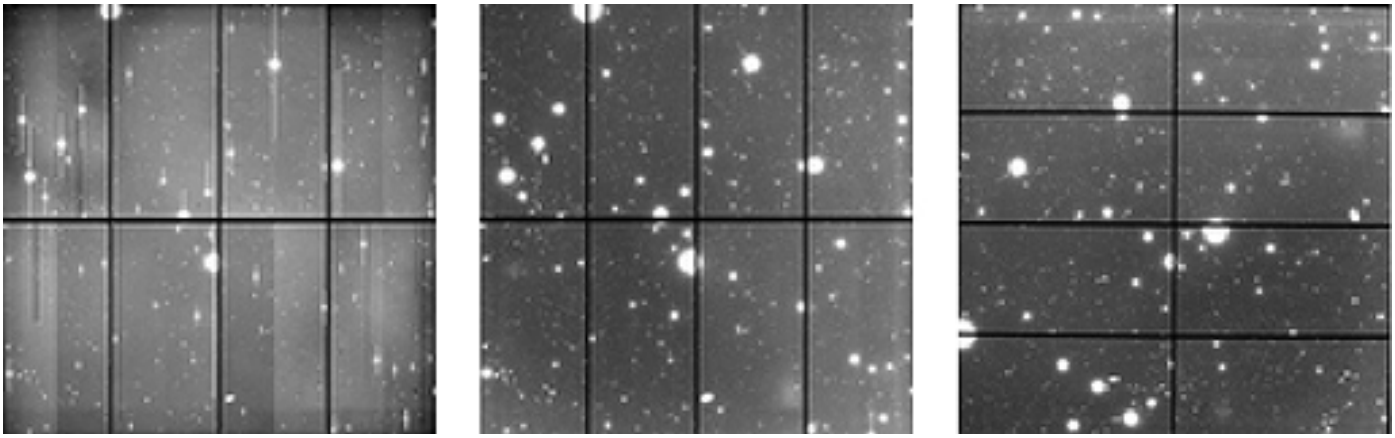

Figure 3: The raw, reduced, and re-projected science frame as automatically created using the NOAO Mosaic pipeline. These data are then automatically characterized to have a zero-point, photometric depth, and seeing estimate: (MAGZERO(i) = 26.61, PHOTDPTH(i) = 22.84, SEEING = 1.0).