Sloan Digital Sky Survey II

2007 SECOND QUARTER REPORT

April 1, 2007 – June 30, 2007

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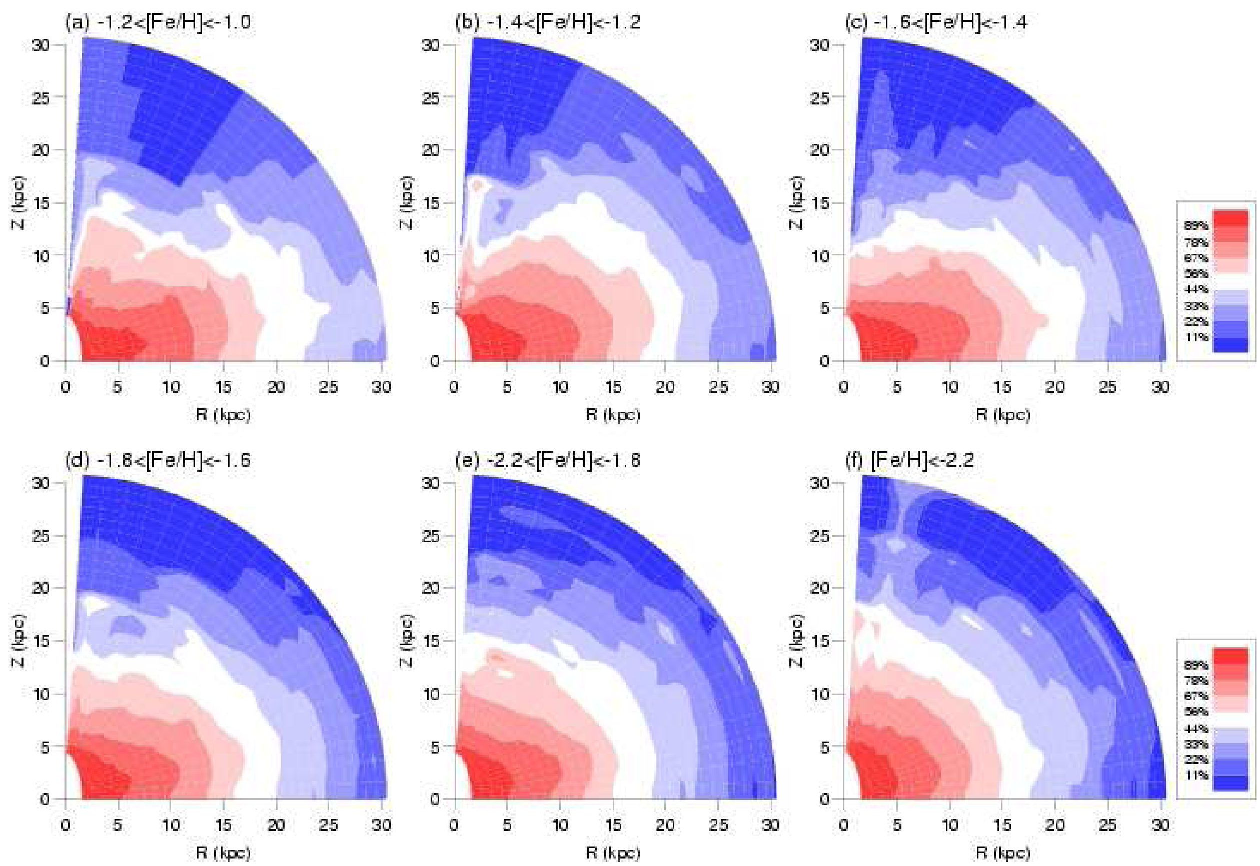
Q2 PERFORMANCE HIGHLIGHTS

- We obtained 84 square degrees of new SEGUE imaging data, against a baseline goal of 303 square degrees. We completed a total of 18 SEGUE plates (10 bright and 8 faint, corresponding to 26 plate-equivalents). This is roughly equivalent to completing 9 SEGUE tiles, against a baseline goal of 17 tiles.
- We completed 55 Legacy spectroscopic plates against a baseline goal of 65 plates (85%). Consistent with our baseline plan, no new Legacy imaging data were obtained.
- We released Data Release 6 (DR6) to the public on June 28, 2007, slightly ahead of the schedule in the approved distribution plan.
- We recorded over 26.3 million hits on our SkyServer interfaces and processed over 1.6 million SQL queries. We also transferred over 5.8 terabytes of data through the Data Archive Server interfaces.
- Q2 cash operating expenses were $974K against a baseline budget of $1,056K, excluding management reserve. In-kind contributions were $222K against anticipated contributions of $190K. No management reserve funds were expended.

1. SOME RECENT SCIENCE RESULTS

The following description, with graphics, briefly highlights some of the scientific work accomplished during the reporting interval (bearing in mind that efforts often spill over into other quarters). Unlike the list of publications given in Exhibits 3 and 4, the topic selected here is by no means comprehensive, nor even representative, of the science being undertaken by the SDSS collaboration. The short science description nevertheless augments our reporting of activities in SDSS-II.

The Two Stellar Halos of the Milky Way



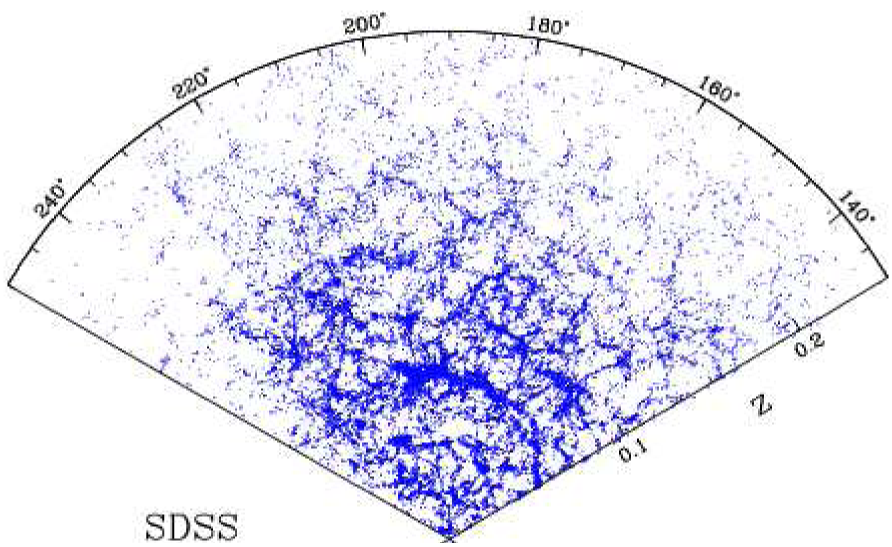
The stellar halo of the Milky Way is an extended, roughly spherical distribution of stars, most of which have a much lower abundance of heavy elements than the Sun and are therefore believed to have formed early in cosmic history, before generations of supernovae had polluted their environments with nucleosynthetic products. As part of the SEGUE component of SDSS-II, the SEGUE team has developed a stellar parameters pipeline that measures heavy element abundances, line-of- sight velocities, and other stellar properties of SDSS spectra. Applying this tool to a sample of 20,000 calibration stars observed during SDSS-I, Carollo et al., identify two chemically and kinematically distinct components of the Milky Way halo. The inner halo is dominated by stars on highly eccentric orbits, with typical heavy element abundance about 1/40 of the solar value. Geometrically, the distribution of inner halo stars is significantly flattened, and it rotates slowly in the same direction as the Milky Way disk. In the outer halo, by contrast, stars are on more nearly circular orbits, the typical heavy element abundance is less than 1/100 of the solar value. The outer halo is more nearly spherical, and its average rotation is opposite to the disk's rotation.

The diagram above shows contours of stellar density in the Milky Way halo, in narrow windows of heavy element abundance, ranging from about 8% of the solar value in the upper left to below 0.6% in the lower right. These maps are constructed by combining the SDSS velocities of nearby halo stars with a model of the Milky Way's gravitational potential. The inner, red contours show a transition from a flattened distribution to an approximately spherical distribution at roughly 1% of the solar heavy element abundance. These results illustrate the power of combining information stellar motion and chemical abundance information for an enormous sample of stars. When completed, SEGUE will enable these kinds of studies with samples an order of magnitude larger.

References:

1. The Dichotomy of the Galactic Halo of the Milky Way, by D. Carollo et al., submitted to Nature, ArXiv astro-ph e-print 0706.3005.

Cosmic Voids Were Emptied By Gravity



The earliest 3-dimensional maps of the galaxy distribution showed that galaxies lie in filamentary super clusters interlaced by vast zones of emptiness, cosmic voids tens of millions of light years across that contain few or no bright galaxies. These voids are clearly visible in the above map from the SDSS, which shows the distribution of galaxies in a thin wedge on the sky. The earth is at vertex of the cone, and the most distant objects shown are 3 billion light years away.

A new analysis of galaxy clustering in the SDSS shows that these voids not just empty of galaxies; they are also missing the “halos" of invisible dark matter that bright galaxies reside in. The SDSS team first determined the relation between galaxies and dark matter halos by matching the galaxy clustering in dense regions of the SDSS map - the web of filamentary super clusters that interweaves the network of empty bubbles and tunnels. With this relation in hand, they used some of the world's largest supercomputer simulations to predict the number and sizes of voids, obtaining excellent agreement with the SDSS measurements. These results imply that dark matter halos of the same mass host similar kinds of galaxies regardless of their large scale environment. In more general terms, they show that the sizes and emptiness of observed voids are naturally explained by the standard cosmological model, in which cosmic structure forms by the gravitational amplification of small perturbations in the early universe, together with straightforward assumptions about the relation between galaxies and dark matter.

References:

1. Void Statistics in Large Galaxy Redshift Surveys: Does Halo Occupation of Field Galaxies Depend on Environment?, by J. Tinker, C. Conroy, P. Norberg, S. G. Patiri, D. H. Weinberg, and M. S. Warren, to be submitted to The Astrophysical Journal.

2. SURVEY PROGESS

The period of accounting for this report includes three observing runs spanning the period from April 6, 2007 through June 23, 2007.

2.1. Legacy Survey

Table 2.1 compares the imaging and spectroscopic data obtained against the Legacy baseline plan. No new Legacy imaging data was obtained in 2007-Q2.

Table 2.1. Legacy Survey Progress in 2007-Q2

	2007-Q2		Cumulative through Q2	
	Baseline	Actual	Baseline	Actual[1]
Legacy Imaging (sq. deg)	0	0	7808	7577
Legacy Spectroscopy (tiles)	65	55	1521	1505

Due to marginal weather conditions, we fell short of the Q2 baseline goal for obtaining new spectroscopic data. We completed 55 plates against a baseline goal of 65. Through the end of Q2, we have completed 1505 plates, which is 1% short of the cumulative goal of 1521 plates.

The following graphs show progress against the baseline plan. Figure 2.1 shows historical progress against the baseline plan for the Legacy Survey. Figure 2.2 shows progress on the spectroscopic survey. In order to provide a better view of progress against plan, the axis scales on Figure 2.2 have been adjusted to show progress made since July 2005, the start of SDSS-II operations.

[1] When the baseline plan for SDSS-II was prepared, we estimated that the total area to be imaged was 7808 “footprint” square degrees. We “closed the gap” in the imaging footprint at the end of June 2006 and declared the imaging survey to be complete. At that time, the actual area imaged was 7561 square degrees. Since then, and as time and conditions permit, we plan to continue obtaining small amounts of imaging data in order to fill in small missing areas on stripes 23 and 33.

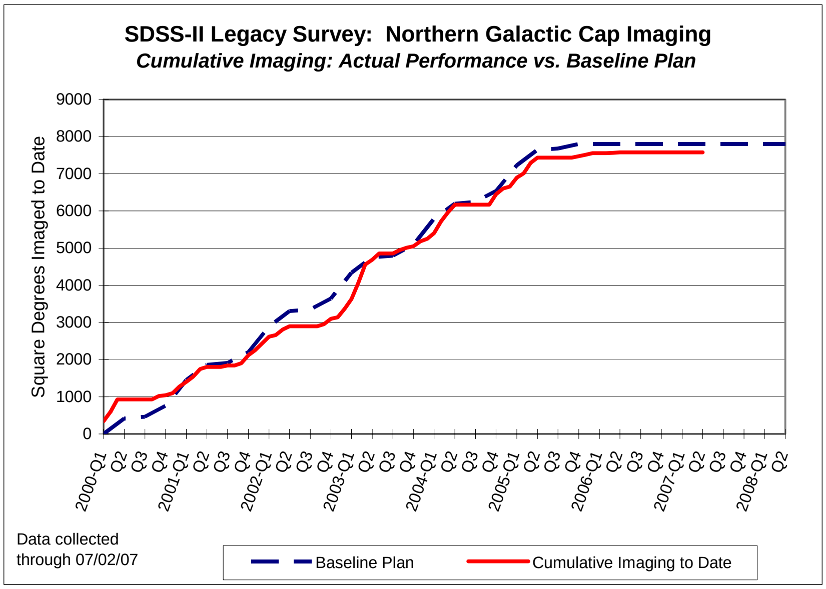


Figure 2.1. Imaging Progress against the Baseline Plan – Legacy Survey

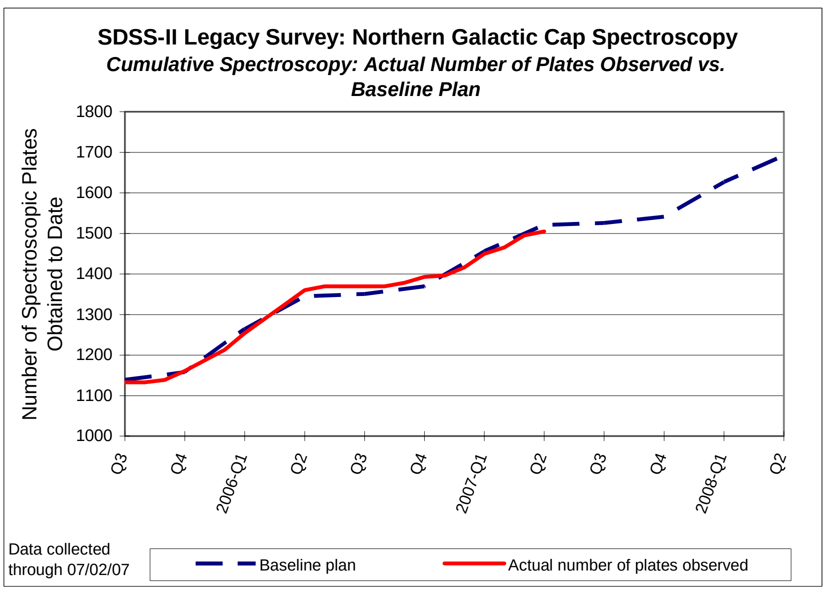


Figure 2.2. Spectroscopic Progress against the Baseline Plan – Legacy Survey

2.2. SEGUE Survey

Table 2.2 compares SEGUE progress against the baseline plan. For the quarter, we obtained a total of 84 square degrees of new SEGUE imaging data against a baseline goal of 303 square degrees. The data were obtained on stripes 205 and 1540 under photometric conditions during the April observing run.

Table 2.2. SEGUE Survey Progress in 2007-Q2

	2007-Q2		Cumulative through Q2	
	Baseline	Actual	Baseline	Actual
SEGUE Imaging (sq. deg)	303	84	2670	3205
SEGUE Spectroscopy (bright plates)	17	10	123	115
SEGUE Spectroscopy (faint plates)	17	8	123	103

A total of 18 SEGUE plates (10 bright and 8 faint, corresponding to 26 plate-equivalents) were completed. This is roughly equivalent to completing 9 SEGUE tiles, against a baseline goal of 17 tiles. Recall that a SEGUE tile is considered complete when the faint and bright plate combination for a field is observed. Our observing strategy is arranged to complete plate pairs in roughly the same time frame, in order to maximize the scientific usefulness of each plate pair. However, it is not always efficient to complete plates in "pair combinations" given the many factors that affect observing operations (atmospheric conditions, available time, etc.) Therefore, we have elected to separately report progress in terms of the number of bright and faint plates completed, as opposed to combined bright/faint plate pairs (i.e., SEGUE tiles).

The SEGUE Survey is ahead of the baseline in imaging due to the acquisition of SEGUE data prior to July 2005, when commissioning and proof-of-concept observations were made. The SEGUE Survey is behind the spectroscopic baseline for bright and faint plates due to marginal weather conditions

Figure 2.3 shows the current SEGUE layout and progress map, as of June 30, 2007. The plot can be found online at: http://segue.uchicago.edu/skycoverage.html

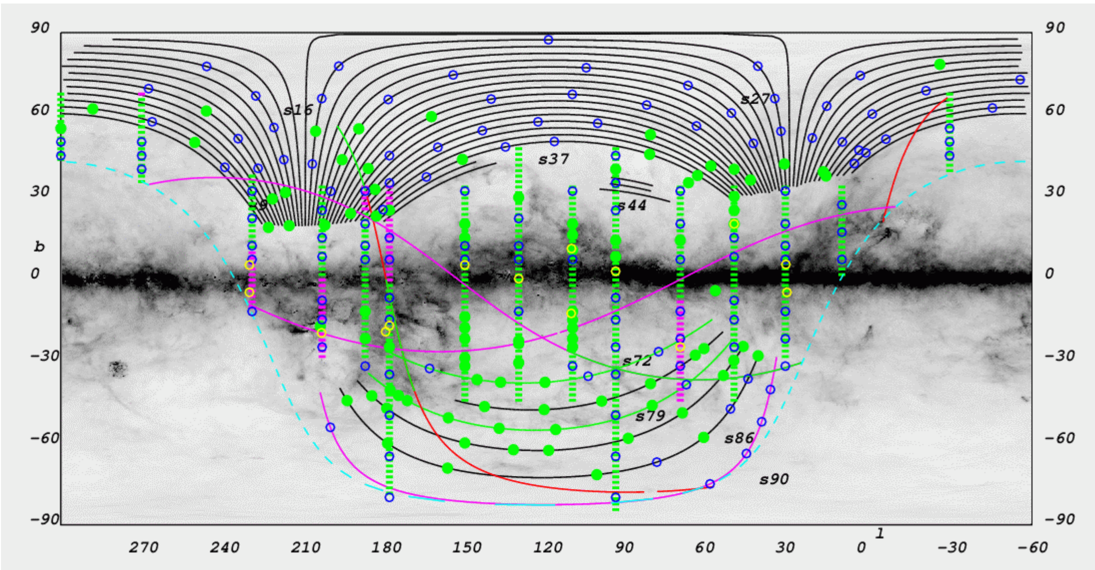


Figure 2.3. SEGUE Imaging Sky Coverage and Plate Layout (as of June 30, 2007).

Figures 2.4 and 2.5 illustrate SEGUE progress against the baseline plan. The imaging graph presents a straightforward comparison of imaging progress against plan. The spectroscopy graph shows the rate at which we are completing bright and faint plates separately.

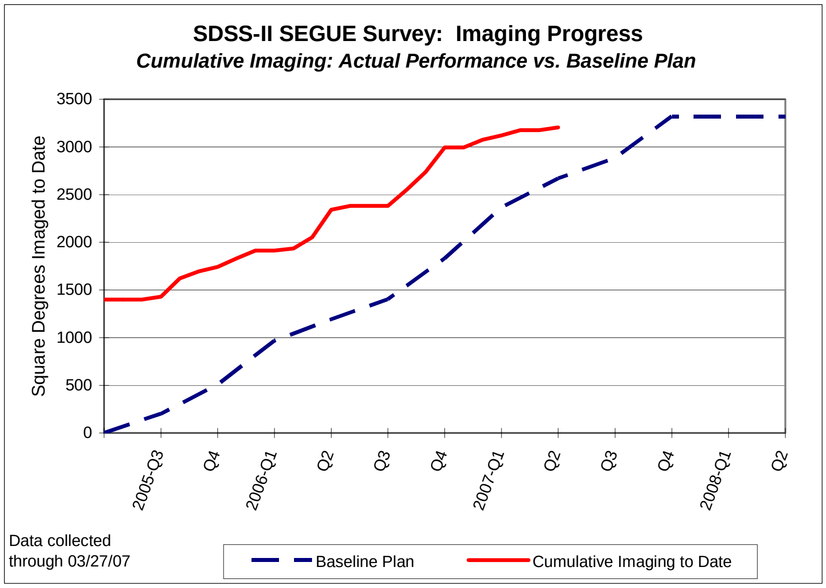


Figure 2.4. Imaging Progress against the Baseline Plan – SEGUE Survey

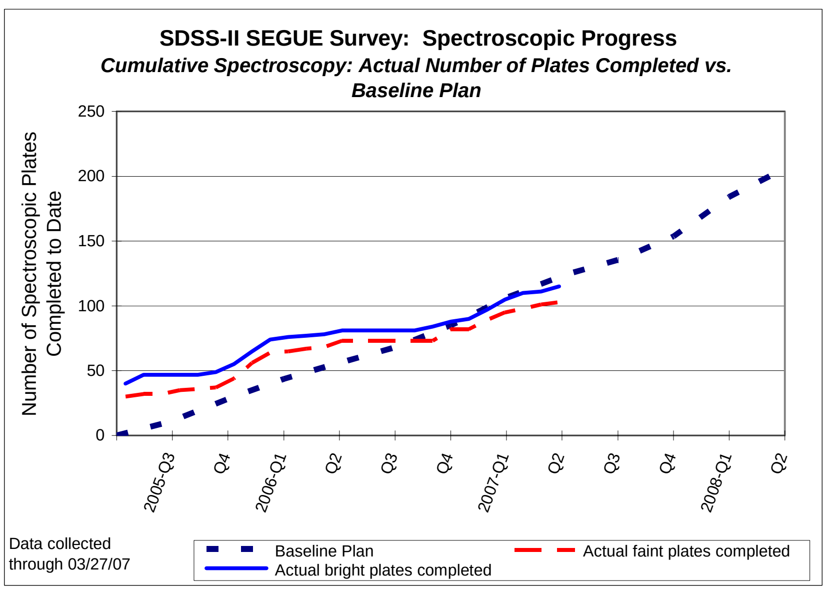


Figure 2.5. Spectroscopic Progress against the Baseline Plan – SEGUE Survey

SEGUE is unlikely to finish all 206 tiles (about 400 plates) by the end of June 2008, therefore the SEGUE collaboration will prioritize the remaining plates for best science usefulness. It is likely that some low-latitude plates may be dropped from top priority. The Survey Coordinator is also working with the SEGUE project leaders and project management to optimize the observing strategy for the coming observing season.

The USNO-1m observing program in support of SEGUE had only one night scheduled this quarter. This night was part of a 6 night observing run, 5 of which occur in the third quarter. As such, the observing run will be discussed as a whole in the Q3 report.

In addition to supporting observing operations, the SEGUE team was involved in several other activities:

- In conjunction with DR6:
  - A SEGUE public web page was released to the public (http://segue.uchicago.edu).
  - 169 plates (approximately 96,000 stellar spectra) of SEGUE data were released to the public.
  - 1166 square degrees of lower latitude SEGUE imaging were released to the public.
  - The first release of results from the SEGUE stellar parameters pipeline was made available to the public.
- A collaboration-accessible SEGUE wiki was launched for exchange of figures and data.
- The stellar velocity accuracy for SEGUE (reducing residuals from +/15 km/s --> +/- 5 km/s) was a great success, and done in time for the DR6 release.

In Q3 2007, SEGUE will make the last change to its target selection algorithm, namely to try and improve bright red giant selection for objects with colors redder than g-r = 0.8

2.3. Supernova Survey

No observing time was allocated to the Supernova Survey in Q2, in accordance with the SDSS-II observing plan Work this quarter focused on continuing analysis of fall 2006 SDSS Supernova data and preparation for the fall 2007 run.

2.4. Photometric Telescope

The Photometric Telescope (PT) observed 99 secondary patch sequences during Q2. Of these, 50 were deemed survey quality after processing and 49 were declared bad. The PT also observed 74 manual target sequences over this time period; of these, 69 were of indeterminate quality (they were part of a planetary nebulae program which uses a non-SDSS filter and thus require special processing that is not part of standard operations); one (a solar analog for use in absolute calibration) was deemed survey quality after processing; and four (2 solar analogs and 2 test exposures) were declared bad.

3.0 OBSERVING EFFICIENCY

Observing efficiency is summarized according to the categories used to prepare the baseline projection.

3.1. Weather

Table 3.1 summarizes the amount of time lost to weather and Figure 3.1 plots the fraction of suitable observing time against the baseline forecast. Averaged over the quarter, the fraction of available observing time was much worse than predicted in the baseline plan. The baseline predicted that weather would be suitable for observing 60% of the time. By month, weather conditions in April were only suitable for observing 42% of the time. Conditions in May were better but still short of the baseline goal, with 53% of the available time suitable for observing. June weather conditions were worse with 40% of the available time suitable for observing.

Table 3.1. Potential Observing Hours Lost to Weather in Q2

Observing Condition	Total hours potentially available for observing	Total hours lost to weather	Fraction of time suitable for observing	Baseline Forecast
Dark Time	284	155	45%	60%
Dark & Gray Time	394	217	45%	60%

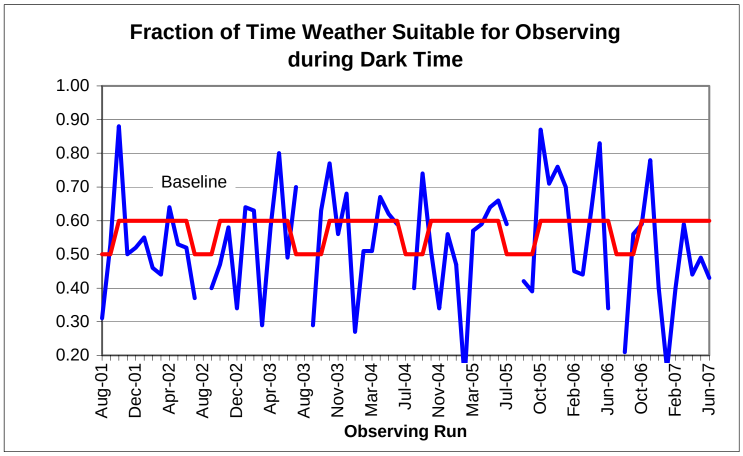


Figure 3.1. Percentage of Time Weather Suitable for Observing

3.2. System Uptime

System uptime measures the availability of equipment when conditions are suitable for observing. We averaged 98% uptime against a baseline goal of 90%. Table 3.2 summarizes the total amount of time lost to equipment or system problems and Figure 3.2 plots uptime against the baseline goal.

Table 3.2. Potential Observing Hours Lost to Problems in Q2

Observing Condition	Total hours potentially available for observing	Total hours lost to problems	System Uptime	Baseline Forecast
Dark Time	284	6	98%	90%
Dark & Gray Time	394	7	98%	90%

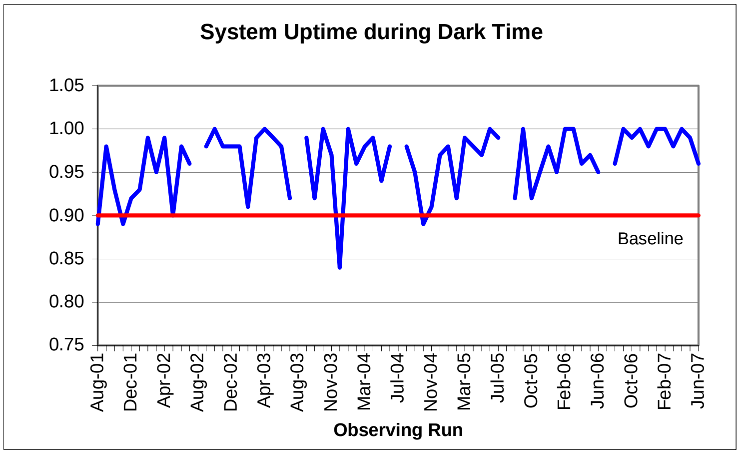


Figure 3.2. System Uptime

3.3. Imaging Efficiency

Imaging efficiency averaged 72% against a baseline goal of 86 Efficiency was below the baseline for the quarter due to a large number of short imaging runs in the quarter. Shorter runs tend to drive down efficiency because setup and calibration time reflect a larger fraction of the total time spent per scan. It is also worth noting that due to poor weather conditions, for the first time in the history of the survey there was no imaging in the month of the May,

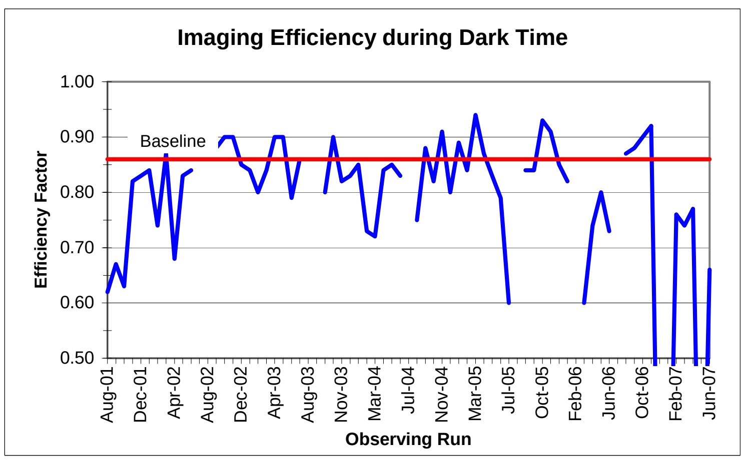


Figure 3.3. Imaging Efficiency

3.4. Spectroscopic Efficiency

Spectroscopic efficiency is derived by assessing the time spent performing various activities associated with spectroscopic operations. Table 3.3 provides the median time, by dark run, for various overhead activities associated with spectroscopic operations. Units for all categories are minutes except for efficiency, which is given as the ratio of baseline science exposure time (45 minutes) to total time required per plate. Using these measures, spectroscopic efficiency exceeded baseline goals; average efficiency in Q2 was 68% against the baseline goal of 64%.

Table 3.3. Median Time for Spectroscopic Observing Activities

Category	*Baseline*	*Run starting Apr 6*	*Run starting Ma y 6*	*Run starting Jun 6*
Instrument change	10	5	4	5
Setup	10	8	7	7
Calibration	5	6	6	6
CCD readout	0	3	3	3
Total overhead	25	22	20	21
Science exposure (assumed)	45	45	45	45
Total time per plate	70	67	65	66
Efficiency	0.64	0.67	0.69	0.68

Figure 3.4 plots spectroscopic efficiency over time and shows that efficiency continues to remain strongly above the baseline goal.

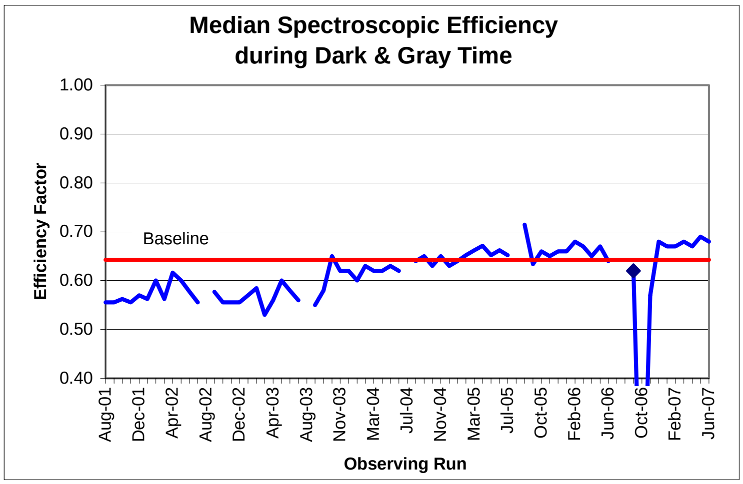


Figure 3.4. Spectroscopic Efficiency

4. OBSERVING SYSTEMS

Observing systems includes the instruments, telescopes, computers and various sub-systems that support observing operations at APO.

4.1. The Instruments

There were no significant problems with the imaging camera, spectrograph, or PT camera during Q2. Instrument-related work included the fabrication of spectrograph camera cradles to facilitate camera handling and safety once the cameras are removed from their respective spectrographs as part of the summer shutdown work plan.

A new LN2 sensor body design was tested and proven to be superior to an older design. Sensors incorporating the new design have been incorporated into the spectrograph autofill system. We plan to replace LN2 sensors in the imager autofill system in the near future.

The SDSS observing staff and the Japan Participation Group (JPG) jointly conducted linearity measurements on the imaging camera in late June, using the imager calibration system. The latest set of measurements incorporates revised measurement parameters. During the measurements, some troubles were encountered with the X-Y stage of the calibrator; these are described in the following section.

The JPG is preparing a report summarizing the results of QE measurements since 1999. The first draft has been written and is being internally reviewed. The JPG plans to make the document available to the collaboration within the next quarter.

4.2. The 2.5m Telescope

Q2 activities have traditionally been focused around addressing telescope problems and preparing for the annual summer shutdown, and this quarter was no exception. Our most pressing concerns related to summer shutdown planning are the organization of the utility runs in the Primary Support Structure (PSS), the Flat Field Screen drive system, and spectrograph camera handling.

The following list highlights some of the engineering work performed in the quarter:

1) The emergency closing system for the 2.5m telescope was modified to simplify the emergency closing procedure. To use the old system, the observers were required to disconnect and re-connect a series of Burndy electrical connectors in order to obtain manual control of the Wind Baffle. Manual control is necessary to stow the telescope if site power is lost. Although the sequence of steps required to reconfigure the electrical connections was documented in the Emergency Closing Procedure, it was cumbersome and prone to error under emergency closing conditions. To simplify the process, new hardware was fabricated and integrated in such a way that removed the Burndy connectors from the system. Under the new configuration, manual control of the Wind Baffle is now obtained through a set of mechanical switches.

2) Following up on the instrument latch booster pump failure described in the 2007-Q1 report, we implemented a backup pump system that allows the observing staff to continue nighttime operations in the event of a primary latch pump system failure.

3) Following up on the controller for the Imager Calibrator described in the 2007-Q1 report, we learned that the stage controller is obsolete and no longer available. The site engineering staff is working with the calibrator system developers to determine an appropriate course of action going forward.

4) Several of the machine tools in the APO machine shop are on loan to the project from Fermilab. The current plan is to return these tools when the SDSS-II project ceases APO operations in mid-2008. As a result, the site engineering staff has begun seeking out replacement equipment. In Q2, the NMSU Astronomy department donated a milling machine from an unused machine shop on the Las Cruces campus. The milling machine was transferred to APO during Q2, and a vertical milling machine and cutoff saw were returned to Fermilab. The site staff is still seeking replacements for two lathes and a band saw.

5) Problems experienced with the Flat Field Screen this quarter were due to two causes – mechanical failure and inadequate training provided to technical personnel to perform maintenance on the Flat Field Screen system. The training problem has been resolved; the

mechanical failure will be addressed during summer shutdown by the installation of keyways cut into the drive sprockets.

6) A temporary flat field screen was built in preparation for upcoming tests of a monochromatic calibration system for the imager.

7) One of the new neon/argon calibration lamps failed while in use. The vendor was concerned that the lamp failed had so quickly and has asked that the failed lamp be returned to help determine the cause of the failure. We have replaced the failed lamp in the calibration system and will rewire the lamp controllers to help stabilize lamp control.

8) At the end of Q2, and just before the start of the summer shut down, we discovered that the astigmatism actuator controller for the 2.5-m primary mirror was malfunctioning. A possible cause may be leaks at the connections between air lines and fittings on the astigmatism actuators distributed throughout the PSS. We will test for and repair any leaks during the summer shutdown. We will also examine the actuator controller.

9) Major summer shutdown preparation work consisted of many activities, including:
   a) Ordering and organizing components needed to accomplish the rewiring of the secondary truss. This upgrade will minimize damage to the PSS-Truss interface connections and eliminate some of the air flow obstructions within the PSS plenum.
   b) Investigation into the appropriate procedure to rewire the isolation transformer and frequency filter for the imager backup UPS.

4.3. The Photometric Telescope

The Photometric Telescope (PT) worked well throughout the quarter, with no significant problems to report.

4.4. Operations Software and the Data Acquisition System

Observing software at APO was stable over this quarter; all changes were minor and handled by the observatory staff.

The data acquisition (DA) system was stable throughout the quarter. Testing on the DA test-stand at Fermilab confirmed that the three VCI+ cards used in the test-stand were fully operational. Since we are no longer performing active DA development, we no longer need three cards on the test stands, so two of the tested cards were sent to APO and placed into the spares pool. In Q3, we plan to ship untested cards from the APO spares pool to Fermilab for testing and validation on the test-stand. This will provide us with the assurance that all of the cards in the test pool are functioning properly.

4.5. Observatory Operations

Responsibilities for key staff at Apache Point Observatory were rearranged this quarter, in coordination with ARC, SDSS project management, and the director of the APO 3.5-m telescope. Bruce Gillespie stepped down as Site Operations Manager and assumed the new role of ARC Program Manager. Mark Klaene was appointed the new APO Site Operations Manager.

Except during scheduled engineering shutdown periods, the SDSS telescope, instruments, and data acquisition systems were operated by the observing staff in support of the science observing plan. Operations continued to run smoothly and there were no recordable personnel injuries. All site infrastructure support, such as the provision of liquid nitrogen, visitor housing, etc., was furnished as needed.

5. DATA PROCESSING AND DISTRIBUTION

5.1. Data Processing

5.1.1. Software Development and Testing

No changes were made to the production Legacy photometric pipeline in Q2. A new version of the spectroscopic pipeline, idlspec2d_v5, was implemented into production and all spectroscopic data collected to date re-processed using the new pipeline. The re-processed spectroscopic data is included in the DR6 release.

Development work continued at Princeton on the spectroscopic pipeline, the photometric pipeline, and photometric calibration. Development work on the co-addition of the Southern stripe runs also continued.

Work on photometry of globular clusters and open clusters continued, particularly for M67, completing the clusters that needed to be analyzed for the cluster pipeline test paper (Lee et al. 2007).

Work continued by the JINA-MSU team on the development of the SEGUE Stellar Parameter Pipeline. The SEGUE Stellar Parameter Pipeline (SSPP) has been delivered, after modifications based on experiments conducted over the past few months, and has been applied for the executed of the first public release to include SEGUE data, DR6. As a service to the community, the SSPP has also been applied to all of the stellar targets coming from DR5.

The highlights of second quarter's progress are:

- The primary activities related to preparing suitable forms of the outputs from SSPP for the DR-6 public release have been accomplished.

- Two papers describing the methodology of the SSPP, and its validation with Galactic globular and open clusters, have been written and posted to the SDSS collaboration page (Lee et al. 2007a, b). These papers are also linked from the public SEGUE page and the public DR6 page, so that others who wish to use the parameters from the SSPP will be able to obtain this information prior to publication. A third paper is being prepared that describes the validation of the SSPP based on the high-resolution spectroscopy of over 150 SDSS/SEGUE stars, obtained with 8m-10m class telescopes over the past few years. All three papers will soon be submitted to professional journals.

- The JINA-MSU team has continued to explore methods to improve the existing SSPP, including the addition of the ability to determine alpha/Fe and carbon/Fe ratios for stars with sufficiently high-quality spectra. Tests have already shown that both of these efforts should soon converge, likely in time for inclusion in DR7. We are also documenting additional changes in the SSPP that we plan to include in DR7.

In Q3 we plan to continue exploration of new approaches, and refinements, of methods used to obtain stellar parameter estimates in the SSPP. Of particular importance will be the re-calibration of abundance estimates based on the native g-r system, which a few techniques now in use in the SSPP will benefit from (those that are presently using a transformed estimate of B-V).

In addition we will work on incorporation of methods to evaluate parameter estimate errors as a function of S/N, taking advantage of the SDSS spectroscopic noise model recently completed. We have already found that a re-training of the Artificial Neural Network (ANN) approach within the SSPP is greatly improved, relative to the previous version, and we expect to be able to incorporate this version into DR7. Studies of our ability to reproduce known parameter estimates (based on external libraries, including our own high-res estimates) will determine the appropriate limits on S/N that can be set for execution of various techniques in the SSPP. In this manner, we expect to be able to recover parameter estimates for many tens of thousands of stars with lower S/N spectra in the archive. As a result, the numbers of stars with this information will greatly increase in DR7, and naturally be of greater use for the collaboration and the general public.

5.1.2. Data Processing Operations at APO

No data were processed at APO as we were not collecting new supernova data.

5.1.3. Data Processing Operations at Fermilab

There were no major problems or development efforts related to the processing of imaging data this quarter. In Q2, we processed data from one Legacy imaging run and two SEGUE runs.

The version of the spectroscopic pipeline used to process spectra released in DR5 and the initial collaboration release of DR6 contained several bugs that affected SEGUE science. For the public release of DR6, we reprocessed all spectroscopic data with a new version of the pipeline that corrected these bugs. Once this new version was tested and integrated into the production pipeline, the reprocessing went smoothly. In total, we processed data from 2,132 plates. Some of these plates were observed on multiple nights, and we processed each night's data separately; we ran the pipeline on 3,064 sequences of exposures. Of these, we included data from 1,987 plates in DR6.

We continued the migration of our data archive on tape at Fermilab to new media. We are on pace for an expected finish date in July. The only remaining tapes are from early commissioning nights, and these tapes do not have standard log files or other features that require significant human attention.

5.2. Data Distribution

Data distribution activities were focused on supporting existing releases and preparing for public release of Data Release 6 (DR6). DR6 was released to the public on June 28, 2007.

5.2.1. Data Usage Statistics

Through June, the general public and astronomy community have access to the EDR, DR1, DR2, DR3, DR4, DR5 and DR6 through the DAS and SkyServer interfaces. In addition, the collaboration has access to the Runs DB. A helpdesk has been established at Fermilab to respond to user questions, or to system problems reported by users. On average, the helpdesk continues to respond to 1-2 requests per day for help or information.

Figure 5.1 plots the number of web hits we receive per month through the various SkyServer interfaces. In Q2 we recorded 26.3 million hits, compared to 23.9 million hits in Q1.

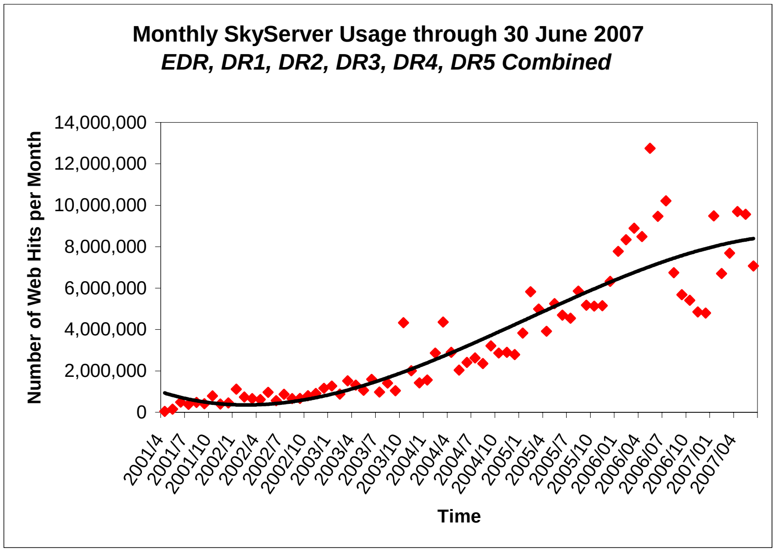


Figure 5.1. SkyServer usage per month, for all public releases combined.

Figure 5.2 shows the total number of SQL queries executed per month. We executed 1.7 million queries in Q2, compared to 1.9 million queries in Q1.

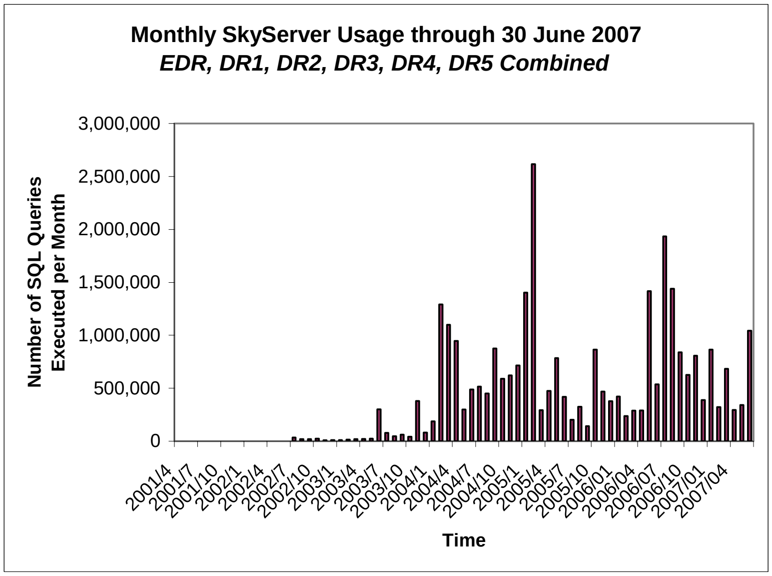


Figure 5.2. SkyServer usage, measured by the number of SQL queries submitted per month.

Through June 30, 2007, the SkyServer interfaces have received over of 261 million web hits and processed over 28 million SQL queries. Over the past quarter, the SkyServer sites received an average of 8.8 million hits each month and processed just over 559K SQL queries per month.

Figure 5.3 shows the volume of data transferred monthly from the DAS through the rsync server. A total of 5.6 TB of data were transferred via rsync in Q2, compared to 4.2 TB in Q1. As we have seen in the past, the volume of data transferred varies significantly from month to month.

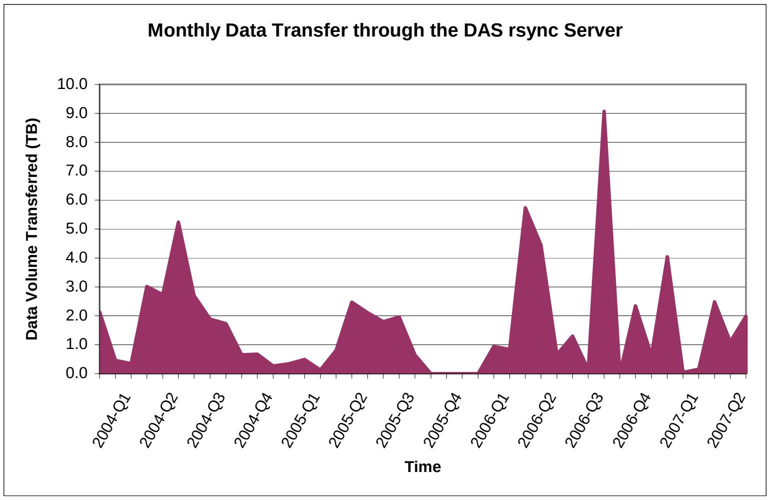


Figure 5.3. Monthly volume of data transferred via the DAS rsync Server.

Figure 5.4 shows the volume of data transferred monthly through the DAS web interface. A total of 0.3 TB of data were transferred via the web interface in Q2, compared to 5.3 TB in Q1.

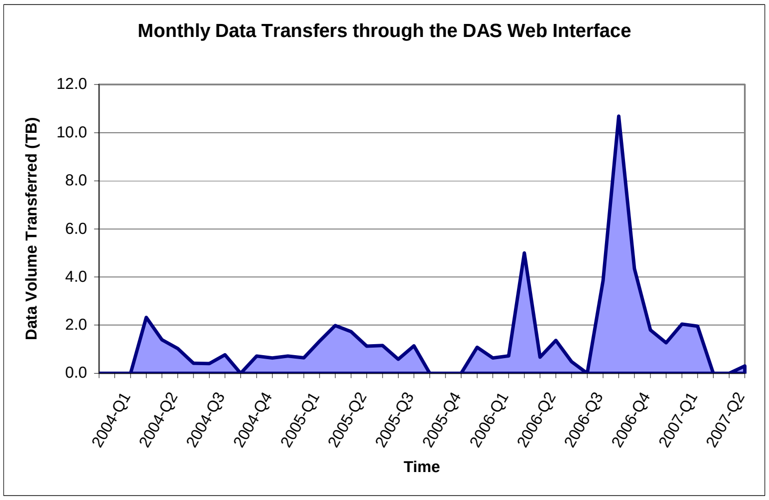


Figure 5.4. Monthly volume of data transferred via the DAS web interface.

Figure 5.5 shows the total volume of data transferred from the DAS through the two access portals combined. In addition to showing total volume transferred, the stacked-area chart shows the fraction transferred via each method (rsync vs. web interface). Historically, the majority of data transfers have been made using rsync, suggesting that rsync is the preferred transfer method for large data transfers. In Q2, 95% of the data transferred was via the rsync interface and 5% was via web interface.

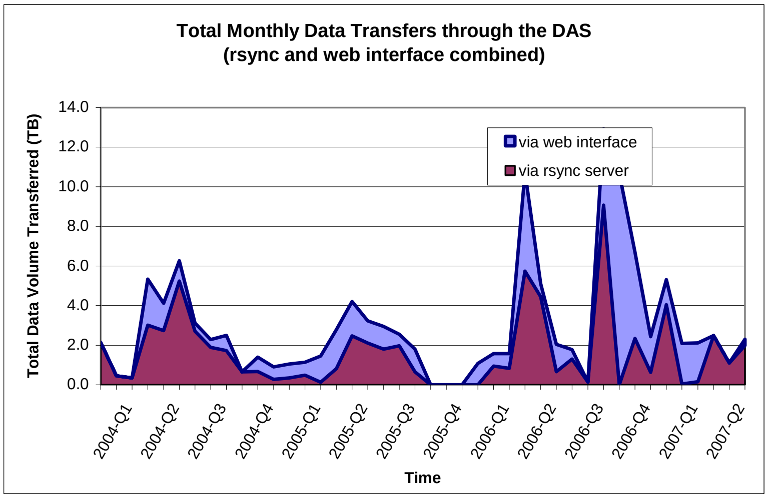


Figure 5.5. Total monthly volume of data transferred via the DAS

5.2.2. Data Release 6

As earlier noted, we released DR6 to the public on June 28. In addition to including new Legacy and SEGUE data, DR6 contains the spectroscopic results produced by the new version of the spectroscopic data reduction pipeline, results generated by the new SEGUE Stellar Parameters Pipeline, and numerous improvements to the CAS.

5.2.3. Data Archive Server

There were no significant activities related to the Data Archive Server (DAS) in Q2, nor were there any significant hardware problems affecting data accessibility. The majority of efforts associated with DAS were related upgrades necessary to accommodate the DR6 release, and providing general support for data distribution operations.

5.2.4. Catalog Archive Server

Work on the Catalog Archive Server (CAS) included addressing problem reports, preparing for the DR6 public release, and providing general support for data distribution operations.

A total of 25 problem reports filed through the SDSS Problem-Reporting Database were fixed and closed, including three filed as critical/high (all against CasJobs).

A significant amount of work went into final preparations for the DR6 public release, including:

- loading and testing Ap7Mag and UberCal tables and functions;
- loading photo-z tables, QSO tables and the DR5 quasar catalog;
- creating the new table “DR5QuasarCatalog” and renaming the table “QuasarCatalog” to “DR3QuasarCatalog”;
- updating Algorithms, Table Descriptions and other documentation tables;
- updating documentation to include the Ubercal algorithms;
- applying DR6 patches and bug fixes to all copies of the DR6 databases on the FNAL servers;
- fixing sector code and creating sector and new HTM installation scripts;
- testing “sectors” fixes at JHU and running them on the DR6 databases at FNAL;

- adding the new DR6 file servers to the log harvester and testing to verify that the harvesting of usage statistics included all DR6 machines;
- creating log sources for the new servers and adding linked servers;
- implementing DR6 metadata and documentation updates;
- incorporating DR6 sector installation scripts into the database schema.

In addition, work for CasJobs support and enhancements included:

- deploying v3_1_0 on the test machine and then deploying it to production;
- providing helpdesk support
- several updates (v3_1_0->v3_2_1)
- implementing a new privileges scheme using "groups" tables; and
- implementing schema updates for batchadmin.

Finally, as part of our long-term stewardship and archiving planning, we met with the library staff at the University of Chicago and John Hopkins University to discuss details and finalize plans for setting up mirror sites of the DR5-CAS and SkyServer. We intend to order and configure the computing hardware required to support the mirror sites in Q3, and finish the implementation of the mirror sites in Q4.

6. SURVEY PLANNING

6.1. Observing Aids

Several programs are used to aid in planning and carrying out observations; no changes were made to these in Q2.

6.2. Target Selection

In Q2, 24 plates were designed and drilled in one drilling run. All 24 plates were for the Northern survey area.

6.3. Survey Planning

An exhaustive inventory has been undertaken of all data tapes acquired during the first five years of the survey. The data from these tapes is being copied to the Fermilab tape robot system since the capability of reading these types of tapes (DLT) at Fermilab will soon be phased out.

7. EDUCATION AND PUBLIC OUTREACH

We made modifications to the education pages of the sdss.org web site in response to items learned and/or suggestions resulting from conversations with scientists at the SDSS collaboration meeting held at Drexel University in March 2007.

We set up plans for the summer by recruiting staff to work on an educator's guide to the SDSS. We also started planning for the SDSS follow-up projects to be done at Manastash Ridge Observatory in the summer.

We made plans for an SDSS EPO presence at future professional conferences. We submitted a proposal for a session on SDSS education at the 2008 National Science Teachers Association conference in Boston. We also made arrangements to have an SDSS exhibit booth at the meeting of the Astronomical Society of the Pacific, which will be held in Chicago in September 2007.

We conducted a three hour "SDSS in Your Classroom" workshop for five high school teachers who are offering the University of Washington's Astronomy 101 course for college credit. A list serve has been created so the group can discuss their use of SDSS education activities.

We met with the Director of Science Programs at the Educational Equity Center (EEC) at the Academy for Educational Development in New York City. The purpose of the meeting was to familiarize the EEC with the SkyServer and how SkyServer might be used in science programs for older kids in after-school programs.

We collaborated on a proposal submitted to the NSF Informal Science Education entitled iSEE: An Informal Science Education Enhancement for SkyBrowser. SkyBrowser is the name we used for Google Sky prior to its public release. It will invariably involve linking with SkyServer and thus will make the SDSS Web sites more visible to educators.

Several SDSS follow-up research projects began in June 2007. One high school teacher is doing observations of RR Lyra candidates that were derived from the SDSS database. Another high school teacher is observing some known symbiotic stars and some candidates derived from the SDSS database. A UW undergraduate is collaborating with this teacher on the symbiotic star project with funding provided by the Washington NASA Space Grant Consortium and the Kenilworth Fund.

EPO planned activities in the third quarter include the following:

- The SDSS follow-up observing projects at Manastash Ridge Observatory will continue through the summer.
- We will begin work for SDSS EPO. The top priority will be to develop an "educator's users manual" (including an abbreviated vocabulary list) for the SkyServer and, if there is time, to develop an additional "simple" (for younger ages) exercise, likely in connection with SDSS-II data that have been released. A few teachers will be enlisted to review and provide feedback as the contents develops. We will offer a small stipend for teachers who participate.
- We will continue the SDSS database project on identifying objects that might be planetary nebulae in the halo of the Milky Way Galaxy. Candidate objects will be investigated by an UW graduate student.
- We will host the SDSS exhibit booth at the Astronomical Society of the Pacific conference in September.

8. COST REPORT

The operating budget that the Advisory Council accepted and the Board of Governors approved for SDSS-II activities during the period January 1 through December 31, 2007 consists of $720K of anticipated in-kind contributions from Fermilab, the University of Chicago (UC), the Johns Hopkins University (JHU), the University of Washington (UW), and the Joint Institute for Nuclear Astrophysics (JINA); and $4,856K for ARC-funded cash expenses.

Table 8.1 shows actual cost performance for ARC-funded cash expenses in Q2. More complete tables comparing actual to baseline performance are included in the appendices of this report. Exhibit 1 compares cash expenses to the budget and presents the revised cash forecast for 2007.

Exhibit 2 compares actual in-kind contributions to the budget and presents the revised in-kind forecast for 2007.

Table 8.1. Q2 Cash Expenses and Forecast for 2007 ($K)

	2007 – 2nd Quarter		2007 Operations Budget Total *(for the period Jan-Dec 2007)*	
Category	Baseline Budget	Actual Expenses	Baseline Budget	Current Forecast
1. Survey Management	97	89	477	494
2. Survey Operations				
2.1. Observing Systems	205	156	702	724
2.2. Observatory Operations	433	438	1,732	1,701
2.3. Data Processing	166	168	722	730
2.4. Data Distribution	74	58	491	517
2.5. ARC Support for Survey Ops	4	2	32	17
3. New Development				
3.1. SEGUE Development	43	23	151	132
3.2. Supernova Development	0	0	0	0
3.3. DA Upgrade	0	0	0	0
3.4. Photometric Calibration	23	13	94	75
4. ARC Corporate Support	12	32	44	72
Sub-total	1,056	974	4,446	4,429
5. Management Reserve	103	0	410	410
Total	1,158	974	4,856	4,839

8.1. Q2 Performance - In-kind Contributions

The sum of in-kind contributions in Q2 was $222K against the baseline budget of $190K and was provided by Fermilab, UW, and Michigan State University (MSU) for JINA, as follows:

- Fermilab provided support for survey management, data processing and data distribution activities. Effort was also provided to support oversight and planning, and development work for the SEGUE and Supernova projects. The level of effort provided to support data processing and distribution operations was greater than anticipated, as were some of the salary costs of the individuals performing this work.
- JHU provided support for the development, loading and hosting of the databases associated with the CAS, CasJobs, and SkyServer as anticipated.
- No support was provided by USNO in Q2; no support was required.
- UW contributed the overhead associated with the plate drilling operation as anticipated.
- MSU provided support for the SEGUE project, including development of the SEGUE Stellar Parameter Pipeline. The level of effort provided was as anticipated.

8.2. Q2 Performance – ARC Funded Cash Expenses

ARC-funded expenses were $974K, or $82K (8%) below the budget of $1,056K, before management reserve.

Survey Management costs were $89K against a budget of $97K. Expenses for the Project Scientist, Public Information Officer, ARC Spokesperson and Collaboration Affairs were less than anticipated. Expenses for the Public Affairs office, ARC Business Manager and ARC Office of the Secretary/Treasurer were as anticipated. Expenses for the Director, EPO Coordinator, and project management support staff were higher than anticipated. Included in the 2007 forecast is $18K for two summer students at Princeton which will be funded by the NSF REU award. For the year, the revised forecast for Survey Management expenses is $494K, or $17K (4%) above the baseline budget of $477K. The 2007 forecast is at budget after adjusting for the NSF REU award.

Observing Systems costs were $156K against a budget of $205K. Fermilab, Princeton and UW costs were less than budgeted. Salary expense was lower than plan driven by an open technician position which will be filled in the third quarter. The ARC Observing System Support costs includes the salary expense for an observer who was planned as part of the NMSU budget but could not be hired by NMSU until after receipt of a degree. The observer will join the NMSU staff in the third quarter, with future salary expenses charged against ARC account SSP235. ARC Observing System Support will be over budget for the year due to the expenses for the observer and additional expenses in Q3 and Q4 for support at JHU. For the year, the revised forecast for Observing Systems expenses is $724K, or $22K (3%) above the baseline budget of $702K.

Observatory Support costs were $438K against a budget of $433K. Although operations expenses for the quarter were up, the concurrent under-runs in salary and other categories brought the total for this quarter to almost exactly the budgeted amount, leaving intact the residual under-run accumulated during the first quarter. The office of ARC Program Administrator was created effective June 1. This position is posted at Apache Point and administered through JHU. A principal responsibility for the Program Administrator in support of SDSS-II is to facilitate the successful completion of the current survey and to make arrangements for a relatively seamless transition to planned post-2008 projects. For the year, the forecast for Observatory Support expenses is $1,701K, or $31K (2%) below the baseline budget of $1,732K.

Data Processing costs were $168K against a budget of $166K. Actual expenses at Fermilab were below budget because miscellaneous hardware expenses for DLT tapes and other computer hardware were less than anticipated. Actual expenses at Princeton and University of Chicago were greater than anticipated due to part of the scientists' time being charged to data processing instead of SEGUE development work. The overage in data processing costs is offset by under spending in SEGUE development. For the year, the revised cost forecast for Data Processing is $730K, or $8K (1%) above the baseline budget of $722K.

Data Distribution costs were $58K against a budget of $74K. Fermilab and JHU expenses were lower than budgeted because ARC-funded salary costs were less than anticipated. For the year, the cost forecast for Data Distribution is $517K or $26K (5%) above the baseline budget of $491K.

ARC Support for Survey Operations costs were $2K against a budget of $4K. Unspent Q2 funds from the Observers' Research Support budget and the Additional Scientific Support budget have not been carried forward in the forecast. The baseline budget for Q3-Q4 should adequately meet needs in both of these areas. As a result, we predict that actual expenses will be substantially less than budgeted. Overall, the revised forecast for Survey Operations support is $17K, or $15K (49%) below the baseline budget of $32K.

Expenses associated with development work for the SEGUE Survey were $23K against a budget of $43K. Expenses to support software development work at Ohio State were in reasonable agreement with the budget. Expenses for development work at Princeton were less than budget due to part of the scientists' time being charged to data processing instead of development work. Expenses for software development work at University of California Santa Cruz are included in the forecast for Q3 and Q4. For the year, the revised forecast is $132, or $19K (13%) below the baseline budget of $151K.

Expenses associated with photometric calibration efforts at Princeton were $13K against a budget of $23K. For the year, the revised forecast is $75, or $19K (20%) below the baseline budget of $94K.

Miscellaneous ARC corporate expenses (i.e., audit fees, bank fees, petty cash, and APO trailer rentals) were $32K against a budget of $12K. The increase is driven by the addition of a Bobcat tractor that was not included in this year's capital improvements plan. For the year, the revised forecast is $72K against the baseline budget of $44K.

8.3. Q2 Performance - Management Reserve

No management reserve funds were expended in Q2. Unspent management reserve funds have been carried forward into Q3 and Q4.

9. PUBLICATIONS

In Q2, there were 14 papers based on SDSS data that were published by members of the SDSS collaboration. There were also 22 papers published by individuals outside of the collaboration, using publicly available data. Exhibit 3 lists papers published by members of the SDSS Collaboration; Exhibit 4 lists papers published by individuals outside of the SDSS collaboration.

Exhibit 1. CY2007 Cash Budget Forecast ($000s)

SDSS-II CY2007 Cost Performance as of July 31, 2007

			Qtr 1 Jan-Mar	Qtr 2 Apr-Jun			Qtrs 3-4 Jul-Dec			CY2007 Total		
		Inst	Actual Expenses	Approved Baseline Budget	Actual Expenses	Variance (%)	Approved Baseline Budget	Jul-2007 Forecast	Variance (%)	Approved Baseline Budget	Jul-2007 Forecast	Variance (%)
OPERATIONS BUDGET - CASH EXPENSES												
1.0 Survey Management												
SSP-221	ARC Secretary/Treasurer	ARC	2	2	2	6%	7	7	-4%	12	11	0%
SSP-234	ARC Business Manager	ARC	16	18	17	7%	34	37	-7%	69	69	-1%
SSP-246	PU Office of the Project Scientist	PU	.2	3	.1	97%	66	66	0%	73	66	9%
SSP-248	FNAL Support for Survey Management	FNAL	13	14	19	-32%	29	47	-63%	58	79	-38%
SSP-267	UC Support for Survey Management	UC	16	14	18	-30%	51	51	0%	79	85	-8%
SSP-270	UW Support for EPO Coordinator	UW	10	11	12	-4%	25	24	4%	48	46	4%
SSP-274	PU Support for EPO (NSF REU)	PU	0	0	0	---	0	18	---	0	18	-----
SSP-291a	ARC Support for Public Affairs	ARC	18	8	7	8%	0	0	---	16	25	-62%
SSP-291b	ARC Support for Spokesperson	ARC	1	3	0	100%	5	5	0%	10	6	35%
SSP-291c	ARC Support for Collaboration Affairs	ARC	3	16	12	26%	32	30	6%	64	45	30%
SSP-291i	ARC Support for Public Information Officer	ARC	4	8	2	78%	15	15	0%	31	21	31%
SSP-291k	ARC Support for Young Astronomers Travel Fund	ARC	2	0	0	---	0	0	---	0	2	-----
SSP-291L	ARC Support for EPO Webmaster and Teacher	ARC	0	0	0	---	20	20	0%	20	20	0%
	Survey Management Sub-total		**86**	**97**	**89**	9%	**284**	**320**	-12%	**477**	**494**	-4%
2.0 Survey Operations												
2.1 Observing Systems												
SSP-231	UW Observing Systems Support	UW	30	47	45	3%	83	92	-10%	168	167	1%
SSP-232	PU Observing Systems Support	PU	12	12	11	2%	26	26	0%	49	49	0%
SSP-242	FNAL Observing Systems Support	FNAL	91	95	76	20%	184	202	-10%	368	370	0%
SSP-261	FNAL Data Acquisition System Support	FNAL	6	6	1	92%	14	14	-1%	27	21	25%
SSP-291d	ARC Observing Systems Support	ARC	36	45	23	50%	29	59	-103%	89	118	-32%
	Observing Systems Sub-total		175	205	156	24%	337	393	-17%	702	724	-3%
2.2 Observatory Support												
SSP-235	NMSU Site Support	NMSU	383	428	434	-1%	837	851	-2%	1,698	1,667	2%
SSP-272	JHU Support for APO Site Management	JHU	0	5	5	---	30	29	2%	34	34	---
	Obseratory Support Sub-total		383	433	438	-1%	866	880	-2%	1,732	1,701	2%
2.3 Data Processing												
SSP-240	FNAL Software and Data Processing Support	FNAL	98	126	116	8%	244	294	-21%	516	508	2%
SSP-238	PU Software and Data Processing Support	PU	42	35	43	-22%	84	84	0%	159	169	-6%
SSP-239	UC Software and Data Processing Support	UC	8	5	9	-73%	36	37	-1%	47	54	-14%
	Data Processing Sub-total		147	166	168	-1%	364	415	-14%	722	730	-1%
2.4 Data Distribution												
SSP-268	FNAL Data Distribution Support	FNAL	110	59	54	8%	191	229	-20%	395	394	0%
SSP-237	JHU Data Archive Development and Support	JHU	6	15	3	78%	56	115	-106%	95	124	-30%
SSP291M	ARC Support for Data Distribution	ARC	0	0	0	---	0	0	---	1	0	100%
	Data Distribution Sub-total		116	74	58	22%	247	344	-39%	491	517	-5%
2.5 ARC Support for Survey Operations												
SSP91f	ARC Additional Scientific Support	ARC	1	0	0	---	0	6	---	18	7	64%
SSP91h	ARC Observers' Research Support	ARC	0	4	2	43%	7	8	-14%	14	10	29%
	Data Distribution Sub-total		1	4	2	43%	7	14	-100%	32	17	49%
	Survey Operations Sub-total		**821**	**881**	**817**	7%	**1,791**	**2,017**	-13%	**3,680**	**3,656**	1%

Exhibit 1. CY2007 Cash Budget Forecast (continued)

SDSS-II CY2007 Cost Performance as of July 31, 2007

		Inst	Qtr 1 Jan-Mar Actual Expenses	Qtr 2 Apr-Jun Approved Baseline Budget	Qtr 2 Apr-Jun Actual Expenses	Qtr 2 Apr-Jun Variance (%)	Qtrs 3-4 Jul-Dec Approved Baseline Budget	Qtrs 3-4 Jul-Dec Jul-2007 Forecast	Qtrs 3-4 Jul-Dec Variance (%)	CY2007 Total Approved Baseline Budget	CY2007 Total Jul-2007 Forecast	CY2007 Total Variance (%)
3.0 New Development												
3.1 SEGUE Survey Development												
SSP-138	PU SEGUE Software Development	PU	14	23	13	42%	48	48	0%	94	75	20%
SSP271	OSU Scientific Support	ARC	9	10	10	0%	9	10	-18%	29	29	0%
SSP273	UCSC Scientific Support	ARC	0	10	0	100%	10	28	-187%	28	28	0%
SSP-268	FNAL Data Distribution Support	FNAL	0	0		---	0	0	---	0	0	---
	SEGUE Development Sub-total		23	43	23	46%	66	86	-30%	151	132	13%
3.2 Supernova Survey Development										0	0	---
	No allocation		0	0	0	---	0	0	---	0	0	---
	Supernova Development Sub-total		0	0	0	---	0	0	---	0	0	---
3.3 Data Acquisition System Upgrade												
	No allocation		0	0	0	---	0	0	---	0	0	---
	DA Upgrade Sub-total		0	0	0	---	0	0	---	0	0	---
3.4. Photometric Calibration Development												
SSP-138	PU Photometric Calibration Development	PU	14	23	13	42%	48	48	0%	94	75	20%
	Photometric Calibration Sub-total		14	23	13	42%	48	48	0%	94	75	20%
	New Development Sub-total		**36**	**66**	**37**	44%	**114**	**134**	-18%	**245**	**207**	16%
4.0 ARC Corporate Support												
SSP291e	ARC Corporate Support	ARC	20	12	8	31%	21	20	2%	44	49	-11%
SSP291g	ARC Capital Improvements	ARC	0	0	23	---	0	0	---	0	23	---
	ARC Corporate Support Sub-total		**20**	**12**	**32**	-163%	**21**	**20**	2%	**44**	**72**	-64%
Cash Budget Sub-total			**964**	**1,056**	**974**	8%	**2,210**	**2,491**	-13%	**4,446**	**4,429**	0%
5.0 Management Reserve		ARC	0	103	0	100%	205	410	-100%	410	410	0%
TOTAL CASH BUDGET			**964**	**1,158**	**974**	16%	**2,415**	**2,901**	-20%	**4,856**	**4,839**	0%

Exhibit 2. CY2007 In-Kind Contribution Forecast ($000s)

SDSS-II CY2007 Cost Performance as of July 31, 2007

		Inst	Qtr 1 Jan-Mar Actual Expenses	Qtr 2 Apr-Jun Approved Baseline Budget	Qtr 2 Apr-Jun Actual Expenses	Qtr 2 Apr-Jun Variance (%)	Qtrs 3-4 Jul-Dec Approved Baseline Budget	Qtrs 3-4 Jul-Dec Jul-2007 Forecast	Qtrs 3-4 Jul-Dec Variance (%)	CY2007 Total Approved Baseline Budget	CY2007 Total Jul-2007 Forecast	CY2007 Total Variance (%)
OPERATIONS BUDGET: IN-KIND												
1.0 Survey Management												
SSP-248	FNAL Support for Survey Management	FNAL	27	35	23	34%	71	56	21%	140	106	24%
	Survey Management Sub-total		**27**	**35**	**23**	34%	**71**	**56**	21%	**140**	**106**	24%
2.0 Survey Operations												
2.1 Observing Systems												
SSP-231	UW Observing Systems Support	UW	15	15	15	0%	30	30	0%	60	60	0%
	Observing Systems Sub-total		15	15	15	0%	30	30	0%	60	60	0%
2.3 Data Processing												
SSP-239	UC Software and Data Processing Support	UC	0	5	10	-102%	10	10	-1%	19	19	-1%
SSP-240	FNAL Software and Data Processing Support	FNAL	89	85	91	-8%	173	173	0%	342	352	-3%
SSP-269	MSU SEGUE Software Development and Support	MSU	0	0	0	---	0	0	---	0	0	---
	Data Processing Sub-total		89	89	101	-13%	182	182	0%	361	372	-3%
2.4 Data Distribution												
SSP-237	JHU Data Archive Development and Support	JHU	0	11	27	-155%	28	22	21%	50	49	0%
SSP-268	FNAL Data Distribution Support	FNAL	19	14	18	-32%	28	28	0%	56	66	-17%
	Data Distribution Sub-total		19	25	46	-86%	28	50	-80%	106	115	-9%
	Survey Operations Sub-total		**123**	**129**	**162**	-25%	**240**	**263**	-9%	**527**	**547**	-4%
3.0 New Development												
3.1 SEGUE Survey Development												
SSP-237	JHU Data Archive Development and Support	JHU	0	11	22	-100%	0	0	---	22	22	0%
SSP-269	MSU SEGUE Software Development and Support	MSU	16	16	16	0%	0	0	---	31	31	0%
	SEGUE Development Sub-total		16	26	37	-41%	0	0	---	53	53	0%
	New Development Sub-total		**16**	**26**	**37**	-41%	**0**	**0**	---	**53**	**53**	0%
TOTAL IN-KIND CONTRIBUTIONS			**166**	**190**	**222**	-17%	**311**	**318**	-2%	**720**	**706**	2%
TOTAL OPERATING BUDGET (Cash and In-kind)			**1,130**	**1,349**	**1,195**	11%	**2,726**	**3,219**	-18%	**5,575**	**5,545**	1%

Exhibit 3. Papers from within the SDSS Collaboration

1. A Quasar with Broad Absorption in the Balmer Lines. AJ 133:1271 (2007) – P. B. Hall,
2. On the Selection Effect of Radio Quasars in the Sloan Digital Sky Survey. AJ 133:1615 (2007) – Y. Lu, et al.
3. The UV Properties of SDSS-Selected Quasars. AJ 133:1780 (2007) – G. B. Trammell, et al.
4. Internal and Collective Properties of Galaxies in the Sloan Digital Sky Survey. AJ 658:884 (2007) – Y-Y. Choi, et al.
5. Environmental Dependence of Properties of Galaxies in the Sloan Digital Sky Survey. AJ 658:898 (2007) – C. Park, et al.
6. Cosmological Parameters from the SDSS DR5 Velocity Dispersion Function of Early-Type Galaxies through Radio-selected Lens Statistics. ApJL 658:71 (2007) – K-H Chae
7. Andromeda X, a New Dwarf Spheroidal Satellite of M31: Photometry. ApJL 659:21 (2007) – Daniel Zucker, et al.
8. Luminosity Dependence of the Spatial and Velocity Distributions of Galaxies: Semi-Analytic Models Versus the Sloan Digital Sky Survey. MNRAS 376:984 (2007) – C. Li, et al.
9. Clustering of High-Redshift (z >= 2.9) Quasars from the Sloan Digital Sky Survey. AJ 133:2222 (2007) – Y. Shen, et al.
10. A MaxBCG Catalog of 13,823 Galaxy Clusters from the Sloan Digital Sky Survey. AJ 660:239 (2007) – B.P. Koester, et al.
11. Virgo Cluster Early-Type Dwarf Galaxies with the Sloan Digital Sky Survey. III. Subpopulations: Distributions, Shapes, Origins. ApJ 660:1186 (2007) – T. Lisker, et al.
12. The 8 O'Clock Arc: A Serendipitous Discovery of a Strongly Lensed Lyman Break Galaxy in the SDSS DR4 Imaging Data. ApJL 662:51 (2007) – S. S. Allam, et al.
13. The Properties of Jovian Trojan Asteroids listed in SDSS Moving Object Catalogue 3. MNRAS 377:1393 (2007) – G. M. Szabó, et al.
14. Properties of Wide-Separation Lensed Quasars by Clusters of Galaxies in the Sloan Digital Sky Survey. MNRAS 378:469 (2007) – G. L. Li, et al.

Exhibit 4. Publications Based on Public Data

1. Line Emission in the Brightest Cluster Galaxies of the NOAO Fundamental Plane and Sloan Digital Sky Surveys. MNRAS 379:100 (2007) – L.O.V Edwards, et al.

2. On the Prevalence of Radio-Loud Active Galactic Nuclei in Brightest Cluster Galaxies: Implications for AGN Heating of Cooling Flows. MNRAS in press – P. N. Best, et al.

3. Power Law Correlations in Galaxy Distribution and Finite Volume Effects from the Sloan Digital Sky Survey Data Release Four. A&A 465:23(2007) – F. Sylos Labini, et al.

4. Initial Mass Function Effects on the Colour Evolution of Disk Galaxies. A&A 465: 417 (2007) – P. Westera, et al

5. Reconstructing the Cosmic Evolution of Quasars from the Age Distribution of Local Early-Type Galaxies. ApJ 658:721 (2007) – Z. Haiman, et al.

6. Inclination-Dependent Luminosity Function of Spiral Galaxies in the Sloan Digital Sky Survey: Implications for Dust Extinction. ApJ 659:1159 (2007) – Z. Shao, et al.

7. Peculiar Motions in the Region of the Ursa Major Supercluster of Galaxies. Astr Letters 33, 211 (2007) – F. G. Kopylova, et al.

8. The Properties of Optical FeII Emission Lines of AGN with Double-Peaked Broad Emission lines. RevMexAA 43:101 (2007) – X.-G. Zhang, et al.

9. The Mass and Luminosity Functions and the Formation Rate of DA White Dwarfs in the Sloan Digital Sky Survey. A&A 466:627(2007) – Q. Hu, et al

10. Truncations of Stellar Disks and Warps of HI-Layers in Edge-on Spiral Galaxies. A&A 466:883 (2007) – P. C. van der Kruit

11. The sigma-L Correlation in Nearby Early-Type Galaxies. AJ 133:1954 (2007) – M. Bernardi

12. The Lowest Mass White Dwarf. ApJ 660:1451 (2007) – M. Kilic, et al

13. Properties of Luminous Red Galaxies in the Sloan Digital Sky Survey. MNRAS 377:787(2007) – T. Barber, et al.

14. SDSS J1130+0058 an X-shaped Radio Source with Double-Peaked Low-Ionization Emission Lines: a Binary Black Hole System? MNRAS 377:1215 (2007) – X.-G. Zhang, et al

15. Abundance Diagnosis of E+A (post-starburst) Galaxies. MNRAS 377:1222 (2007) – T Goto

16. The Luminosity-Bias Relation from Filaments in the Sloan Digital Sky Survey Data Release Four. MNRAS 377:L15 (2007) – B. Pandey, et al

17. The Primordial Abundance of 4He: A Self-consistent Empirical Analysis of Systematic Effects in a Large Sample of Low-Metallicity H II Regions. ApJ 662:15 (2007) – Y. I. Izotov, et al.

18. The Black Hole Mass-Galaxy Bulge Relationship for QSOs in the Sloan Digital Sky Survey Data Release 3. ApJ 662:131(2007) – S. Salviander, et al.

19. A Pair of Bootes: A New Milky Way Satellite. ApJL 662:83 (2007) – S.M. Walsh et al.

20. The Identification of Blue Horizontal Branch Stars Using GALEX and Other Photometry. ApJL 662:111(2007) – T. D. Kinman, et al

21. Estimating Photometric Redshifts with Artificial Neural Networks and Multi-Parameters. ChJAA 7, 448 (2007) – L.-L. Li, et al.

22. A Robust Lower Limit on the Amplitude of Matter Fluctuations in the Universe from Cluster Abundance and Weak Lensing. JCAP 6, 24 (2007) – R. Mandelbaum, et al.