

# NATIONAL SOLAR OBSERVATORY



## Quarterly Report (2) FY 2008

01 January - 31 March 2008

Submitted to the National Science Foundation  
Under Cooperative Agreement No. AST-0132798  
Scientific Program Order No. 2

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Also published on the NSO Web site: <http://www.nso.edu>



NSO is operated by the Association of Universities for Research in Astronomy  
under cooperative agreement with the National Science Foundation



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# National Solar Observatory

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*Submitted to the National Science Foundation under  
Cooperative Agreement No. 0132798  
Scientific Program Order No. 2*

Also published on the NSO Web site: <http://www.nso.edu>

This report consists of summary statistics and other data on NSO observing programs and telescope usage, and a safety report for the fiscal quarter ended 31 March 2008. Quarterly highlights of public and educational outreach activities are also described. The appendix contains a comprehensive list of principal investigators and collaborators, program titles, telescopes used, and observing hours associated with observing programs at NSO facilities this quarter.

Scientific highlights and current updates on NSO initiatives, new capabilities, instrumentation, and operational activities are published separately in the quarterly *NOAO-NSO Newsletter*.

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## I. Observing Programs\*

22 observing programs, two of which were thesis programs involving two thesis graduate students and one involving one non-thesis graduate student, were carried out at NSO this quarter. A comprehensive list of PI's, Co-I's, and collaborators, as well as program titles, telescopes used, and observing hours associated with observing programs this quarter is attached as the Appendix.

NSO Observing Programs by Type (US and Foreign)			
3 Months Ending March 2008		Nbr	% Total
Programs (US, involving 1 non-thesis grad student)		20	91%
Programs (non-US)		1	5%
Thesis (US, involving 2 grad students)		1	5%
Thesis (non-US)		0	0%
<b>Total Number of Unique Science Projects*</b>		<b>22</b>	<b>100%</b>

\*Includes observing programs conducted by NSO/NOAO staff scientists.

Users of NSO Facilities by Category					
	Visitors				NSO/NOAO Staff
	US	Non-US	Total	% Total	
PhDs	11	3	14	82%	12
Graduate Students	2	1	3	18%	0
Undergraduate Students	0	0	0	0%	0
Other	0	0	0	0%	12
<b>Total Users</b>	<b>13</b>	<b>4</b>	<b>17</b>	<b>100%</b>	<b>24</b>

Institutions Represented by Visiting Users**				
	US	Non-US	Total	% Total
Academic	4	3	7	70%
Non-Academic	3	0	3	30%
<b>Total Academic &amp; Non-Academic</b>	<b>7</b>	<b>3</b>	<b>10</b>	<b>100%</b>

\*\*Note: Total number of institutions represented by users do not include departments or divisions within an institution as separate entities (e.g., US Air Force and NASA are each counted as one institution even though several different sites/bases/centers are separately listed in the data base).

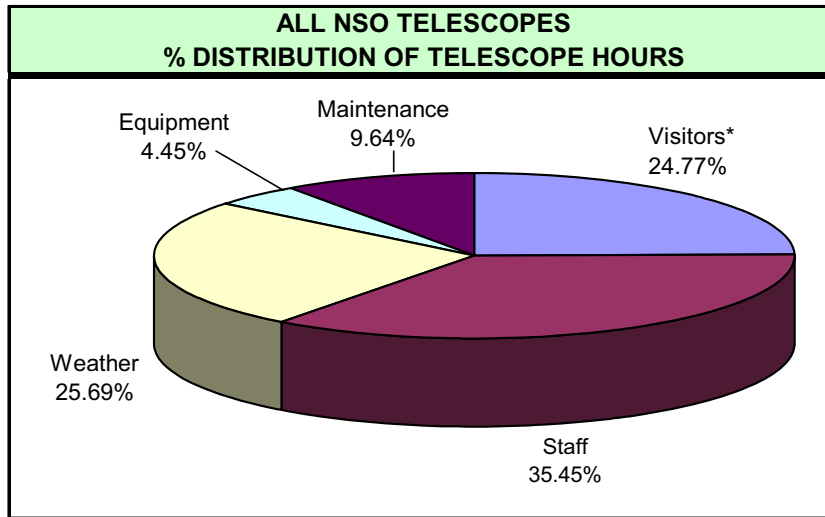
INSTITUTIONS REPRESENTED BY USERS	
<b>Foreign Institutions (3)</b>	
INAF - Arcetri Astrophysical Observatory, Italy	
University of Nice-Sophia Antipolis, France	
University of Sydney, Australia	
<b>US Institutions (7)</b>	
Harvard-Smithsonian Center for Astrophysics	
High Altitude Observatory, NCAR, Boulder	
NASA/Ames Research Center	
University of Arizona	
University of Hawaii, Institute for Astronomy	
University of Maryland	
US Air Force/Philips Lab (USAF/PL/GSS)	

Number of Users by Nationality			
France	2	Australia	1
Italy	1	United States	37

## II. Telescope Usage and Performance Data

In the quarter ending 31 March 2008, 24.8% of the total available telescope hours at NSO/Sacramento Peak and NSO/Kitt Peak went to the observing programs of visiting principal investigators and synoptic programs; 35.4% were devoted to the programs of NSO and NOAO scientists. Scheduled maintenance, including instrument tests, engineering, and equipment changes, accounted for 14.1% of total allotted telescope hours.

Total "downtime" (hours lost to weather and equipment problems) for NSO telescopes was 30.1%. 25.7% of these lost observing hours were due to bad weather, with 4.4% lost to equipment problems.



NSO TELESCOPES Percent Distribution of Telescope Hours (Scheduled vs. Downtime) 01 January 2008 - 31 March 2008						
Telescope	Hours Available	% Hours Used By:		% Hours Lost To:		% Hrs. Lost To:
		Visitors <sup>a</sup>	Staff	Weather	Equipment	Scheduled Maintenance
Dunn Solar Telescope/SP	782.0	24.0%	33.3%	27.1%	0.5%	15.1%
McMath-Pierce*	756.0	6.3%	54.1%	21.8%	9.3%	8.5%
KP SOLIS Tower <sup>b</sup>	48.0	100.0%	0.0%	0.0%	0.0%	0.0%
FTS Lab <sup>c</sup> *	0.0	0.0%	0.0%	0.0%	0.0%	0.0%
Evans Facility	270.0	56.3%	40.0%	40.0%	3.7%	0.0%
Hilltop Dome	32.0	0.0%	0.0%	0.0%	0.0%	0.0%
<b>All Telescopes</b>	<b>1,888.0</b>	<b>24.8%</b>	<b>35.4%</b>	<b>25.7%</b>	<b>4.4%</b>	<b>9.6%</b>

<sup>a</sup> Includes synoptic programs for which all data are made available immediately to the public and the scientific community at large.

<sup>b</sup> Formerly the Kitt Peak Vacuum Telescope (KPVT).

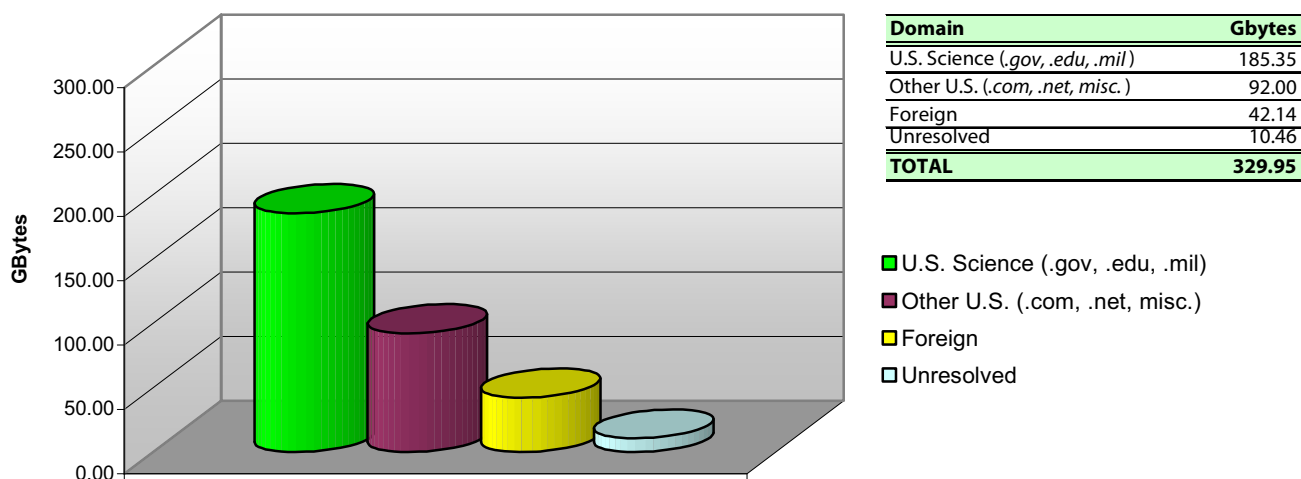
<sup>c</sup> Shut down this quarter for repairs/upgrade.

\*Totals include both day and night hours. (All others are day only.)

### III. User Statistics – Archives/Data Bases

All statistics *exclude* the use of NSO archives and data bases from within the NSO Local Area Networks in Tucson and at Sac Peak, and from NOAO as a whole.

**DATA (Gbytes) DOWNLOADED FROM NSO FTP & WWW SITES**  
01 January – 31 March 2008



**PRODUCT DISTRIBUTION BY DOWNLOADED GBYTES**  
01 January - 31 March 2008

Site	Product Type	Gbytes	%
T	GONG (Magnetograms, spectra, time series, frequencies)	91.00	32.2%
T	GONG Helioseismology	89.78	31.8%
SP	Realtime Images and Movies ( <i>OSPAN, Other</i> )	40.61	14.4%
SP	SMEI Experiment & Data Pages	18.19	6.4%
SP	Press Releases	10.38	3.7%
SP	General Information	9.37	3.3%
T	KPVT (magnetograms, synoptic maps, helium images)	4.88	1.7%
T	SOLIS/VSM	4.81	1.7%
SP	Staff Pages	3.77	1.3%
SP	Corona Maps & Other Images	2.94	1.0%
SP & T	Other	1.84	0.7%
SP	Icon & Background Images	1.65	0.6%
SP	Telescope Home Pages	1.10	0.4%
SP	Public Relations	0.74	0.3%
SP	Adaptive Optics Pages	0.64	0.2%
SP	OSPAN Project Pages	0.64	0.2%
T	FTS (Spectral atlases, general archive)	0.19	0.1%
T	Evans/SP Spectroheliograms (H $\alpha$ , Calcium K images)	0.00	0.0%
<b>TOTAL</b>		<b>282.53</b>	<b>100.0%</b>

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## V. Public and Educational Outreach Activities

NSO public and educational outreach encompasses activities at the Sunspot Astronomy and Visitor Center, including the Visitor Center's retail operations, educational exhibits, and of the NSO/Kitt Peak facilities; Web site outreach, including public information requests; scientific press and media relations; and staff involvement in programs to enhance science education in grades K–12, as well as higher education. Highlights for this quarter follow.

### A. Educational Outreach

#### 1. *Research Experiences for Undergraduates (REU) and Other NSO Summer Research Assistantship (SRA) Programs*

During this quarter, 58 applications were accepted for NSO's 2008 REU Program and 5 applications were accepted for NSO's Summer Research Assistantship Program. Six students were selected for the REU program and three students were selected for the SRA program. In all, a combination of 10 students—six REUs and four SRAs—will participate in summer research opportunities at locations in Tucson and Sunspot for 2008. Included is a PhD candidate (Thomas Schad, University of Arizona), who is supplementing his graduate studies with a summer research assistantship in Tucson with advisor Matt Penn.

Seven applications were accepted for the 2008 NSO/GONG International Research Experience for Students (IRES) Program. Four U.S. graduate students were selected to participate in the program in Bangalore, India this summer.

#### 2. *Other Educational Outreach*

In February, Mark Giampapa, John Leibacher, Bill Sherry, and Roberta Toussaint served as judges at the Fruchthendler Elementary School (Tucson) annual science fair. M. Giampapa was also a judge of lower school science fair posters at St. Michael's Parish Day School in Tucson. Giampapa, with assistance from Bill Sherry (NSO), Nalin Samarasinha (NOAO), Tom Fleming (UofA Steward Observatory), and Robert Sparks (NOAO/PAEO), hosted a star-gazing session at Fruchthendler Elementary School, involving approximately 40 students and parents.

As a Project ASTRO partner, Kerri Donaldson Hanna gave a presentation to a class of fourth graders (approximately 25 students) at Robbins Elementary school in Tucson on what it means to be an observational astronomer. She described what it's like to go to a telescope, how to collect data, what data look like, how to reduce data and what is done to the final data set.

### B. Public Outreach

#### 1. *Sunspot Visitor Center*

<b>Sunspot Astronomy &amp; Visitor Center Summary of Visitors and Tours (3 Months Ending 03/31/08)</b>	
<i>Group/Program</i>	<i>No. of Visitors</i>
General Public Tours (Visits to Center and Self-Guided Tours)	1,600
Guided Public Tours:	
- School Groups K-12	0
- Special Tours	48
<b>Total Visitors</b>	<b>1,648</b>

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## **2. Other Public Outreach, Including External Coordination, Media and Public Information**

On March 1<sup>st</sup>, GONG Program Manager Pat Eliason and ATST Systems Librarian Ruth Kneale participated as career panelists for the 2008 Expanding Your Horizons (EYH) Conference on the University of Arizona (UofA) campus. The conference was presented by Women in Science, Engineering and Technology (WISE), a program of the UofA Women's Studies Department and the Southwest Institute for Research on Women. The EYH conference works to motivate teenage female students to enter careers in science, engineering, mathematics and technology and to support them in their studies.

NSO, in collaboration with NOAO Public and Educational Outreach (PAEO), continues to work toward completing the McMath-Pierce "Sunnel," a project to turn the 95-foot long public hallway of the McMath-Pierce Telescope facility into an exhibit for visitors to Kitt Peak to learn more about the Sun, the NSO, and the telescopes and research associated with the NSO. Staff involved in the development of the Sunnel (with Aimee Norton as scientific contact) met during this quarter to finalize the design and scientific content of the display, including the selection of NSO instrument posters, as well as movies to show as examples of the dynamic solar atmosphere, being selected. The project is moving along rapidly and will be completed in the summer of 2008.

An article about the Advanced Technology Solar Telescope (ATST), "Building the World's Largest Solar Telescope," was written by Dave Dooling and published in the February 2008 issue of the online magazine *400 Years of the Telescope* ([http://www.400years.org/newsletter/400\\_news\\_0208.pdf](http://www.400years.org/newsletter/400_news_0208.pdf)).

During this quarter, internal review of and discussions about NSO Web site improvements occurred, resulting in a new Current Images of the Sun page, comprising a collection of recent images from GONG, SOLIS, OSPAN and AFRL/NSO onto one page. A random display of images has also been implemented on the NSO home page, whereby an image will change whenever the page is loaded, or after 5 minutes. Additional changes/improvements to the NSO Web site will be ongoing.

## **V. Risk Management and Safety Report**

Risk Management services at NSO/Kitt Peak and Tucson are shared with NOAO. Therefore, see the "Tucson and Kitt Peak Site Safety Report" section of the NOAO January – March 2008 Quarterly Report for details on risk management activities at NSO/Kitt Peak and Tucson.

The NSO reported one accident during calendar year 2007, with 8.31 days away from work and 25 days of reduced activity. There were two additional non-reportable incidents.

The Sunspot Volunteer Emergency Medical Service (EMS) added two new EMT's which greatly improves EMS capabilities. Also, training began this quarter for high-angle rescue. The Sunspot Fire Department and EMS now possess an almost new ambulance, pumper truck and rapid response fire truck.

A number of additions and updates were made to the NOAO Safety Web site at <http://www.noao.edu/-noaolocal/safety/>. The Kitt Peak Emergency Manual revision 10 and the Risk Management Manual revision 3 (safety handbook) replaced older versions. New to the Web site, is the Insurance section, which includes links to an international travel checklist; domestic, Hawaii, and international auto rental insurance cards; and the 2008 ACE International Medical Assistance information. The Kitt Peak "mountain" Web site was also updated with the newest version of the Kitt Peak Emergency Manual, in HTML and PDF, and a link to the NOAO Risk Management (Safety) Web site was added.

The NOAO/NSO Contingency Plan was updated, a document called "Open This First" was created for people to use in the event of an emergency, and the contact lists are being updated.



**APPENDIX**  
**National Solar Observatory**  
**01 January - 31 March 2008**

January - March 2008: During this period, 22 observing programs, 2 of which were thesis programs involving 2 thesis graduate students, and 1 involving 1 non-thesis graduate student, were carried out at NSO. Graduate and undergraduate students are indicated by (T) for thesis students, (G) for non-thesis graduate students, (UT) for undergraduate thesis students, and (U) for undergraduate students. (RBSE) identifies middle and high school teachers who are Research-Based Science Education program participants, (REU) identifies Research Experiences for Undergraduates program participants, and (RET) identifies Research Experience for Teachers participants.

	<b>Nights</b>	<b>Days</b>	<b>Hours</b>
<b>2</b>	<b>0.0</b>	<b>3.0</b>	<b>64.0</b>
Claude Plymate                      National Solar Observatory			
Galayda                                      National Solar Observatory			
<i>McMath-Pierce Engineering</i>			
McMath-Pierce Solar Telescope    Main Spectrograph			
<b>1858</b>	<b>0.0</b>	<b>15.0</b>	<b>160.0</b>
William Livingston                      National Solar Observatory			
<i>Cycle Variability of the Solar Spectrum</i>			
McMath-Pierce Solar Telescope    Main Spectrograph			
<b>2058</b>	<b>0.0</b>	<b>10.0</b>	<b>96.0</b>
Andrew Potter                              National Solar Observatory			
Killen    University of Maryland			
<i>Studies of Exospheric Emission Lines in the Inner Solar System</i>			
McMP    Stellar spectrograph			
<b>2058n</b>	<b>0.0</b>	<b>10.0</b>	<b>22.0</b>
Andrew Potter                              National Solar Observatory			
Killen    University of Maryland			
<i>Studies of Exospheric Emission Lines in the Inner Solar System</i>			
McMP    Stellar spectrograph			
<b>2127</b>	<b>0.0</b>	<b>14.4</b>	<b>64.0</b>
Richard Altrock                              USAF Research Laboratory			
<i>Three-Line Coronal Photometer</i>			
Evans Solar Facility (ESF)    Sac Peak			
<b>2128</b>	<b>0.0</b>	<b>13.7</b>	<b>56.0</b>
Simon Worden                              NASA Ames Research Center			
Keil    National Solar Observatory			
<i>Ca K Solar Rotation</i>			
Evans Solar Facility (ESF)    Sac Peak			

		Nights	Days	Hours
<b>2375b</b>		<b>0.0</b>	<b>5.0</b>	<b>29.0</b>
Constance Walker	National Optical Astronomy Observatory			
Plymate	National Solar Observatory			
<i>Understanding the Morphology of Active Regions: Using Zeeman-Split IR Lines to Determine Magnetic Field Strengths of Sunspots</i>				
McMP	Main spectrograph			
<b>2420a</b>		<b>0.0</b>	<b>15.0</b>	<b>150.0</b>
David Elmore	High Altitude Observatory			
Socas-Navarro	High Altitude Observatory, UCAR			
Berst	National Solar Observatory			
Komsa	National Solar Observatory			
Fletcher	National Solar Observatory			
<i>Spectro-Polarimeter for Infrared and Optical Regions (SPINOR) Engineering</i>				
Dunn Solar Telescope/SP	Sac Peak			
<b>2454</b>		<b>0.0</b>	<b>4.0</b>	<b>32.0</b>
Steven Tomczyk	High Altitude Observatory, NCAR			
<i>Coronal Multi-Channel Polarimeter (CoMp)</i>				
Hilltop Dome	Sac Peak			
<b>2489d</b>		<b>0.0</b>	<b>6.5</b>	<b>59.0</b>
Steve Hegwer	National Solar Observatory			
Gilliam	National Solar Observatory			
Elrod	National Solar Observatory			
Gregory	National Solar Observatory			
Long	National Solar Observatory			
<i>Dunn Solar Telescope Maintenance</i>				
Dunn Solar Telescope (DST)	Sac Peak			
<b>2489d</b>		<b>0.0</b>	<b>6.5</b>	<b>59.0</b>
Steve Hegwer	National Solar Observatory			
Smaga	National Solar Observatory			
Whitehorse	National Solar Observatory			
<i>Dunn Solar Telescope Maintenance</i>				
Dunn Solar Telescope (DST)	Sac Peak			

		<b>Nights</b>	<b>Days</b>	<b>Hours</b>
<b>2502a</b>		<b>0.0</b>	<b>10.0</b>	<b>25.0</b>
Alexandra Tritschler	National Solar Observatory			
Woeger	National Solar Observatory			
Rimmele	National Solar Observatory			
Reardon	INAF - Arcetri Astrophysical Observatory			
<b><i>Magnetic Structure from the Photosphere to the Chromosphere</i></b>				
Dunn Solar Telescope/SP	Sac Peak			
<b>2523</b>		<b>0.0</b>	<b>10.0</b>	<b>12.0</b>
Matthew Penn	National Solar Observatory			
Schad (G)	University of Arizona, Lunar & Planetary Laboratory			
<b><i>NSO Array Camera Development</i></b>				
McMath-Pierce Solar Telescope	Main Spectrograph/NSO Array Camera (NAC)			
<b>2525</b>		<b>0.0</b>	<b>5.0</b>	<b>75.0</b>
Matthew Penn	National Solar Observatory			
Schad (G)	University of Arizona, Lunar & Planetary Laboratory			
<b><i>NSO Array Camera High-Resolution Imaging</i></b>				
McMath-Pierce Solar Telescope	Main Spectrograph/NSO Array Camera (NAC)			
<b>2531</b>		<b>0.0</b>	<b>13.0</b>	<b>81.0</b>
Haosheng Lin	University of Hawaii, IFA			
Jaeggli (T)	University of Hawaii, Institute for Astronomy			
<b><i>Facility Infrared Spectro-Polarimeter (FIRS) Engineering &amp; Initial Science Acquisition</i></b>				
Dunn Solar Telescope (DST)	Sac Peak			
<b>2554</b>		<b>0.0</b>	<b>5.0</b>	<b>15.0</b>
Claude Plymate	National Solar Observatory			
<b><i>McMath-Pierce Planetary Adaptive Optics Engineering</i></b>				
McMath-Pierce Solar Telescope	Main Spectrograph			
<b>2557</b>		<b>0.0</b>	<b>6.0</b>	<b>48.0</b>
Edward DeLuca	Harvard-Smithsonian Center for Astrophysics			
Norton	High Altitude Observatory, UCAR			
Henney	National Solar Observatory			
<b><i>Joint Observations Related to Hinode EUV Imaging Spectrometer (EIS) Calibration</i></b>				
Kitt Peak SOLIS Tower (KPST)	SOLIS Vector Spectromagnetograph (VSM)			

		Nights	Days	Hours
<b>2558</b>		<b>0.0</b>	<b>15.0</b>	<b>112.0</b>
Thomas Rimmele	National Solar Observatory			
Berst	National Solar Observatory			
<i><b>DST Camera Control System Testing</b></i>				
Dunn Solar Telescope (DST)	Sac Peak			
<b>2559</b>		<b>0.0</b>	<b>2.0</b>	<b>0.0</b>
Robert Lucas	University of Sydney			
Smartt	National Solar Observatory			
<i><b>Spectral Scans and Calibration of a Dichroic Narrowband Filter</b></i>				
Dunn Solar Telescope (DST)	Sac Peak			
<b>2563</b>		<b>0.0</b>	<b>11.0</b>	<b>15.0</b>
Han Uitenbroek	National Solar Observatory			
Grec (T)	University of Nice-Sophia Antipolis			
Faurobert	University of Nice-Sophia Antipolis			
<i><b>Using Differential Speckle Interferometry to Constrain the Solar Oxygen Abundance</b></i>				
Dunn Solar Telescope (DST)	Sac Peak			
<b>2564</b>		<b>0.0</b>	<b>9.0</b>	<b>49.0</b>
Juan Borrero	High Altitude Observatory, UCAR			
Tomczyk	High Altitude Observatory, NCAR			
Cubo	High Altitude Observatory, NCAR			
Reardon	INAF - Arcetri Astrophysical Observatory			
<i><b>Calibration and Testing of Fe I 6173 for the Solar Dynamics Observatory (SDO) Helioseismic &amp; Magnetic Imager (HMI) using IBIS</b></i>				
Dunn Solar Telescope (DST)	Sac Peak			
<b>2565</b>		<b>0.0</b>	<b>2.0</b>	<b>16.0</b>
Alexandra Tritschler	National Solar Observatory			
Hegwer	National Solar Observatory			
<i><b>Laser Profile Measurements with the Diffraction-Limited Spectro-Polarimeter</b></i>				
Dunn Solar Telescope (DST)	Sac Peak			
<b>2566</b>		<b>0.0</b>	<b>3.8</b>	<b>32.0</b>
Roberto Casini	High Altitude Observatory, NCAR			
Tomczyk	High Altitude Observatory, NCAR			
<i><b>Prominence Magnetometer Observations</b></i>				
Evans Solar Facility (ESF)	Sac Peak			