GONG

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GONG continues to make excellent progress in its transition from a limited-lifetime project to a continuously running program. Near-term milestones include 1) attaining steady state operations of the recently modified high-resolution network instruments, 2) completing the local helioseismology data processing pipeline, 3) obtaining well-calibrated magnetograms, 4) replacing the old "sneaker net" of separate-workstation-based processing of the global helioseismology data with an automated pipeline, 5) developing a replacement instrument, and 6) establishing near-real-time data return from the network.

We are enjoying a respite from failures of the light feed turrets in the field, and are in the process of reengineering the seals as well as designing a weather protection system for them. The local helioseismology pipeline has started production of the "ring diagram" flow maps. While we are exploring a replacement magnetograph modulator, modifications to the driver electronics are being undertaken that should improve the current, as well as any future, modulator's polarization state switching. The first month's comparison of automatic image selection has just been completed and it looks like we are close to its routine use, and the *p*-mode frequency backlog is at an all time low. A design review for the replacement shelter should take place this quarter, and John Kennewell's visit from Learmonth in January highlighted the urgency of getting this done before the salt air there rusts the floor supports completely away!

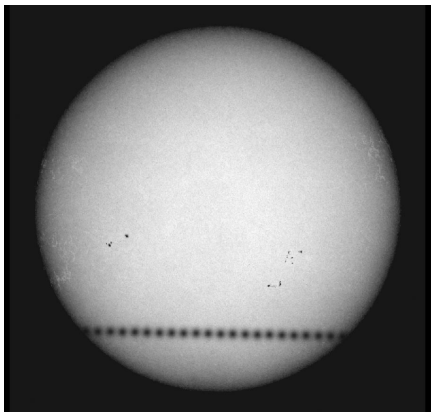

Figure 1. The anticipated path of Venus as it will transit the solar disk on June 8; north is up and east to the left. The images of Venus are spaced 15 minutes apart. The transit will last from 0520 to 1125 UT—in the middle of the night in North America—but should be viewable on the GONG Web site in near-real time from Learmonth, Western Australia; Udaipur, India; and Tenerife, Spain.

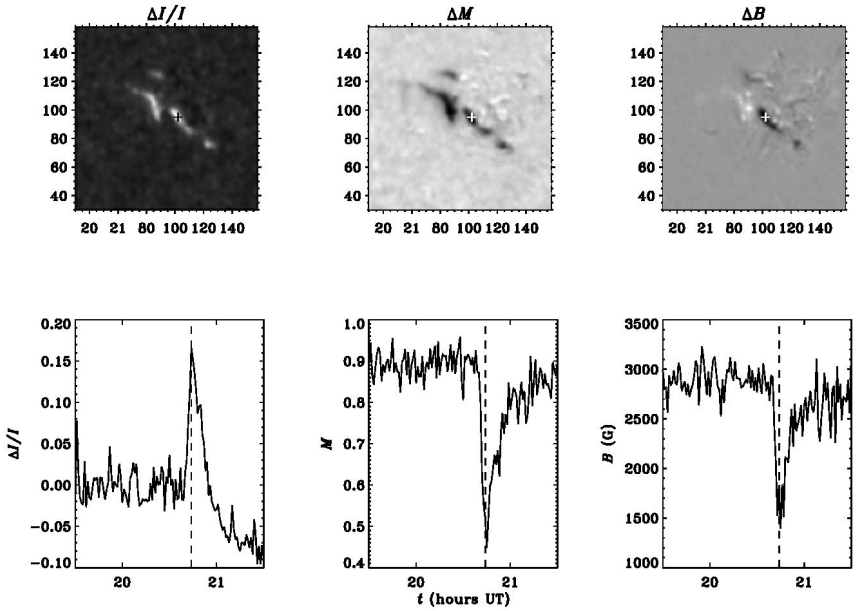

Figure 2. The 28 October 2003 X10 flare in AR10486. Top: Intensity (I), modulation (M), and magnetic field (B) at flare maximum compared to preflare over an area of approximately 4 arcmin on a side (128 pixels). Bottom: Evolution of each quantity over two hours at the pixel marked with a cross in the upper panels; the vertical dashed line indicates the time of the maps above.

Last year's transit of Mercury gave us our first taste of real-time data acquisition, processing, and distribution, and we are looking forward to this year's transit of Venus (see figure 1) and very shortly having farside images of the Sun on line in near-real time. In addition to the global and local helioseismology that is the principal mission of GONG, we are starting to get all sorts of new and interesting science from the high-cadence, high-resolution intensity and magnetograms from the new GONG, for example "white light" imaging from the spectacular series of active regions in October and November 2003 (see figure 2).

Here in Tucson, we've started the modifications of the Data Management and Analysis Center (DMAC), which will result in six new offices on the north side of the building. Phase II, which addresses changes

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on the south end of the building, won't begin until the end of the summer at the earliest. The new offices will house current DMAC staff, a new GONG scientist, and two NASA-funded postdocs.

There are several meetings this quarter to support the GONG community. The GONG's Data Users' Committee (DUC) met in Tucson in February to evaluate progress on all fronts and set objectives for the future. The Local Helioseismology Comparisons (LoHCo) group will also convene in Tucson for a workshop with all of the newly compiled data sets. And, this year's annual meeting—GONG 2004/SoHO 14—is being organized by Yale University and will be held 12–16 July 2004 in New Haven, Connecticut (see figure 3). For more information visit *www.astro.yale.edu/sogo04*.

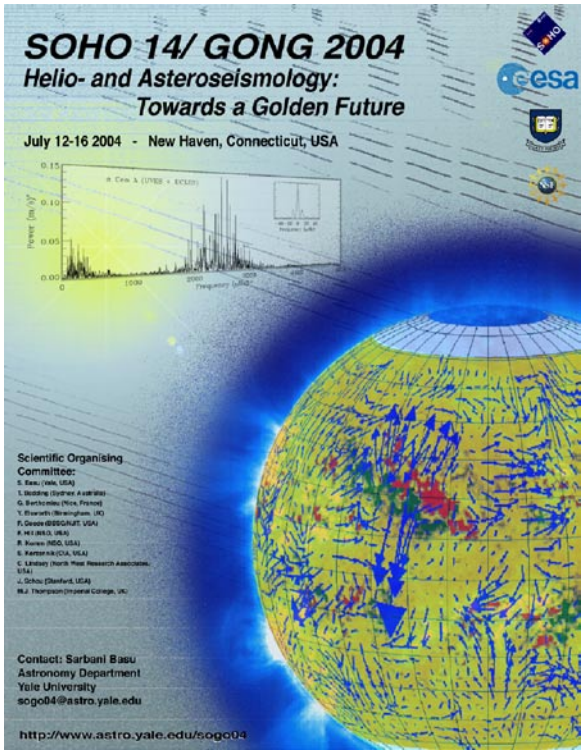

Figure 3. GONG 2004/SOHO 14, organized by Yale University, will be held 12–16 July 2004 in New Haven, Connecticut.

Site and Instrument Operations

A preventive maintenance trip took place at Udaipur in October. The Lyot Filter/Michelson Interferometer Assembly, which had proven to be susceptible to damage from humidity, and the camera, which over the last months showed intermittent variability of the signals from one of its channels, were replaced. The previsit plan also included replacing the telescope turret, however, because of concerns raised by water penetrating the seals of two other recently overhauled turrets, and because physical inspection and electrical checks found no measurable deterioration of the turret at the site, a decision was made to forgo the replacement during that visit. The light feed assembly has since been returned to Tucson and will be the next in line to undergo the newest modifications.

Regarding the light feeds, significant effort in the last quarter focused on how to prevent water leakage into the turrets, and a much improved weather seal was found. However, implementing the new seals into the turret will require some nontrivial modifications. The design and drafting work were completed and a turret was undergoing remachining before the end of the year. The current timeline has modifications complete in January, testing in February, and shipping for installation at Mauna Loa in early March. The remaining turrets will be modified around the network.

Improvements on several other fronts have also been realized. A safety system for securing the optical table during earthquakes was developed and installed at the Tucson site. This supplements the already installed equipment that secures the electronics rack and UPS cabinets, and is ready for installation at the field sites prone to this sort of excitement. Electronic-filtering circuitry that reduces noise generated by the motor driver power supplies has proven beneficial at the Tucson site and is also ready for implementation around the network. Power supply units for the SMD cameras have also been rebuilt with supplies capable of sustaining greater loads. Additional modifications for monitoring supply voltages are underway, and the units may be ready for installation during the next round of preventive maintenance visits. We have been overhauling the currently unused cameras and have produced a set of deployable spares, as well as rebuilt filter/interferometer assemblies. The components are now undergoing tests in preparation for use in the field. New UPS units for all the network sites have been ordered and are expected to be installed during 2004.

A major forest fire approached Big Bear at the end of October, requiring all local residents to evacuate and shutting down the instrument there for about a week. Fortunately, the fire avoided the area, and site operations were restored soon after everyone's return. Also at Big Bear, a disk drive used in the real-time data caching system began to fail. The backup disks, which were designed to prevent any loss of data, kicked in and the site staff installed a replacement. The event was notable

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as it was the first such disk drive failure in the more than two years of GONG+ operation.

Data Processing, Analysis, and Management

The occasional apparent spinning of the Sun seen in the ring-diagram flow maps—the so-called "washing machine effect" reported in the December 2003 *Newsletter*—has been wrung out of the GONG data, thanks to Cliff Toner, Irene Gonzalez-Hernandez, and John Bolding. Cliff implemented a method to determine the angular orientation of the images that uses the MDI legacy data as a fiducial "seventh GONG site." Irene did most of the algorithm evaluation, John fed the data through the pipeline, and Rudi Komm and Rachel Howe performed flow inversions and frequency measurements as added evaluation components. The elimination of the problem means that we can finally proceed with routine production of synoptic flow maps corresponding to Carrington Rotations (CRs). We currently have four completed CRs: 1979, 1987, 1988, and 1989 from August 2002, and March through May 2003.

The end of the spin cycle also means that a substantial amount of new data is available to the LoHCo group. Rudi Komm organized a meeting of the LoHCo group in Tucson February 10 and 11, at which researchers from Yale, Colorado, Stanford, and Colorado Research Associates participated. Materials from a 2 December 2003 conference call are on the Web at *gong.nso.edu/lohco/*.

Jack Harvey, Jeff Sudol, and Rachel Howe have been using the GONG data for some decidedly nonhelioseismic science, by studying the October-November 2003 series of monster flares that rocked our world. It turns out that the flares are very prominent in the GONG intensity, velocity, and in particular, the magnetic field data, where the large change in the magnetic field configuration is highly visible.

Shukur Kholikov has continued to work on developing his time-distance (T-D) code, which was highlighted in the December 2003 *Newsletter.* The program enjoyed an extended visit from Paul Rajaguru who worked with Shukur to install and test his and Mike Thompson's T-D code from Imperial College (London) into the local pipeline system. Shukur is also maintaining the near- and farside holography packages, and Jean Goodrich is working on aspects of the near-real-time processing at the sites that will feed the farside pipeline. GONG was awarded a NASA Living with a Star TR&T grant to develop near-real-time compression and transmission of the images needed for farside imaging from the six GONG instruments, and to produce and distribute farside proxy images on a regular and timely basis. We are working with the sites regarding bandwidth issues, but anticipate the farside pipeline will be in production mode by the end of fiscal year 2004. A postdoc is being sought to calibrate the farside "bounce" signal in terms of the real physical changes of the Sun.

Richard Clark continues to work on the automated rejection of bad images and is currently running his method in parallel with the visual inspection done by Gregg Ladd. Richard will soon have three GONG months of data processed through to global inversions, which will be compared with the traditional handcrafted method. Katrina Gressett is working on producing a three-day-long power spectrum up to degree 1200. This data will be provided to the community for use in developing ridge-fitting techniques.

During the past quarter, month-long (36-day) velocity time series for GONG months 77 and 78 (ending 12 January 2003), with fill factors of 0.87 and 0.86, respectively, were logged into the DSDS, and 698 gigabytes were distributed in response to 24 data requests. The data reduction team has worked hard to pare down the cumulative backlog for GONG+ data products, which is currently down to 194 days. Time series for months 80–84 have been produced but have not yet been entered into the archive. "Peakfind" results up to GONG month 83 (ending 11 July 2003) have been submitted as well. These should make their way to the archive by the end of the month.

Caroline Barban was back for a short visit from her new position in Leuven, Belgium. She says that the cheese and chocolate is much better in Belgium, but the weather is best in Tucson!