# A I P S L E T T E R

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A newsletter for users of the NRAO
*Astronomical Image Processing System*

Written by a cast of *AIPS*

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## General developments in *AIPS*

### Linux news: bad compilers

Instructions for fetching and installing the GNU 2.95.3 compiler are given on the *AIPS* web page. The tar file is directly available from NRAO. This is needed since the 2.96.x compiler does not optimize code properly and the newer GNU 3.0 through 3.2 versions of g77 produce code that executes up to 20% slower than that produced by the older version.

### Current and future releases

We now have formal *AIPS* releases on an annual basis with binary releases only for Solaris and Linux. All architectures can do a full installation from the source files. The current release is called `31DEC02` and is now frozen. If you took a development copy of this version at some earlier date, you may use the "Midnight Job" (MNJ) to bring it up to date. You need to run a MNJ only once in 2003 to convert your copy of `31DEC02` into the now frozen version. This *AIPSLetter* is intended to advise you of developments in this release.

We have begun a new version, called `31DEC03`, which is now under development by the (reduced) *AIPS* Group. You may fetch and install a complete copy of this version at any time. Having fetched `31DEC03`, you may update your installation whenever you want by running the MNJ which uses transaction files to copy and compile the code selectively based on the code changes and compilations we have done. We expect users to take the source-only version of `31DEC03` *AIPS* over the Internet (via *anonymous* ftp).

The MNJ has been changed. The secure shell, with all its fragile complexities, is no longer required. Instead `mnj.aoc.nrao.edu` will serve up *AIPS* incrementally — or as a whole — using the Unix tool `cvs` running with anonymous ftp. Linux sites will almost certainly have `cvs` installed; other sites may have installed it along with other GNU tools. Secondary MNJs will still be possible using `ssh` or `rcp` or NFS as with previous releases. We have found that `cvs` works very well, although it has one quirk. If a site modifies a file locally but in an *AIPS*-standard directory, `cvs` will detect the modification and attempt to reconcile the local version with the NRAO-supplied version. This usually produces a file that will not compile or run as intended.

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### Installing a new version

Some managers of sites that run only the current development version of *AIPS* have asked whether they could upgrade 31DEC02 to 31DEC03 by a simple renaming of the directories and editing of the AIPSPATH files. We have tried this and it did not work. There are a bunch of link files that have to be redone and even then, cvs is too smart and fetches 31DEC02 control files. It might be possible to revise even more files to override this behavior, but at this level it becomes simpler, quicker, and very much more reliable simply to install 31DEC03 from the tar ball.

When installing a new *AIPS* release in a system that already has a previous release, we recommend that install.pl be used and that the previous release be left in place, at least until the installation has been seen to work. If you do this, then you will not have to re-edit the disk, printer, and tape lists and can simply skip all those pages in the install.pl menus. The old $HOME/.AIPSRC file may be left in place, but it will need to be edited. The lines giving the DOWNLOADED and UNPACKED parameters should be deleted and the CCOMOPT line should be changed to point to the current release rather than the previous one — the -I parameter really should be -I$INC but that seems to confuse install.pl. Therefore, for now, the $INC has to be given in its full path name, which forces a re-edit with each release. If you have made special versions of UPDCONFIG and do_daily.*host*, you should preserve them under new names and restore them after the install. The $AIPS_ROOT/AIPSPATH.*SH files will need to be edited after the install if you wish to run multiple different versions of *AIPS*.

For Linux and Solaris Ultra systems only, a binary installation is available from CDrom, supported by install.pl. Alternatively, there are binary files which may be downloaded from

ftp://ftp.aoc.nrao.edu/pub/software/aips/31DEC02.

With a modern computer, it will probably be faster to recompile the programs locally using install.pl.

## Patch Distribution for 31DEC01

As before, important bug fixes and selected improvements in 31DEC01 can be downloaded via the Web beginning at:

http://www.aoc.nrao.edu/aips/patch.html

Alternatively one can use *anonymous* ftp on the NRAO CPU aips.nrao.edu. Documentation about patches to a release is placed in the anonymous-ftp area pub/aips/*release-name* and the code is placed in suitable subdirectories below this. Information on patches and how to fetch and apply them is also available through the World-Wide Web pages for *AIPS*. As bugs in 31DEC03 are found, they are simply corrected since 31DEC03 remains under development. Corrections and additions are made with a midnight job rather than with manual patches. Remember, no matter when you received your copy of 31DEC01 or 31DEC02 *you must* fetch and install its patches if you require them.

The 31DEC01 release had a few important patches including a new one in September. These were:

1. SAD, JMFIT, and IMFIT fail to handle the primary beam correction properly for offset fields *2002-02-11*.
2. IMAGR failed to apply the IMAGRPRM(11) parameter to the peak in the Clean windows *2002-02-19*.
3. SPLAT failed to average spectral channels properly for multiple IFs *2002-06-20*.
4. BPASS failed to include the first record of each SOLINT *2002-09-16*.

# Improvements of interest to users in 31DEC02

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. Despite the reduction in personnel, there have been a number of changes in 31DEC02. In the last edition, we reported on three new tasks: WETHR to plot the contents of the weather table including flagging data based on the contents of the table, BOXES to add Clean boxes to a BOXFILE based on source catalogs, and UVDEC to copy a *uv* data set retaining only every $n^{\mathrm{th}}$ spectral channel. There were also three new verbs: TKERASE to clear the contents of the Tektronix emulation display window, SG2RUN to convert the contents of a SAVE/GET file into a RUN file for use on another computer and/or user number, and OUTPUTS to show those adverbs whose values will be changed when running the task. A new RUN file called WRTPROCS provides three procedures for automated writing and reading of FITS disk files.

In the last six months, we have developed two new tasks: WIPER to edit *uv* data interactively from a UVPLT-like display and LOCIT to solve for antenna positions. For the VLA, the latter replaces an ad hoc pair of programs that only ran on Solaris and were no longer maintainable. The VLBA pipeline reduction VLBAPIPE package has been publicly released. "Color" was added to *AIPS*' plotting. This allows contrasting symbols and contour and polarization lines to be drawn on top of gray-scales. Full pseudo- and true-coloring were also made available. A wide variety of tasks were enhanced in some way.

Other than relatively minor differences, 31DEC02 is compatible in all major ways with the 2001, 2000, 1999, and 15OCT98 releases. There are significant incompatibilities with older versions.

## Plotting in color

Several new plot command codes have been developed: line type (values 1–4), dark vector, write RGB gray-scale, initialize for color gray-scales, and write bright and dark characters inside plot area. These allow different line types to be assigned different colors both when they are bright or when they need to be "dark" because they are drawn over significant gray-scale brightness. They allow the labeling, contouring, polarization vector drawing, and "star" plotting routines to draw in a contrasting color when the background gray-scale is strong. They allow the conversion of gray-scales with a color table (called an "output-function-memory" or "OFM") to pseudo colors and the full display of a true-color (RGB) image such as those produced by TVHUI and RGBMP. Examples of color plotting are given at the end of this *AIPSLetter*.

All plot tasks in *AIPS* were changed to use the line-type command. GREYS was changed to support FUNCTYPE, to do dark vectors when needed to plot contours and stars, to read an OFM to color the gray-scale image, and to construct and display RGB images from an input RGB image or 3 different input images. PCNTR was changed to plot gray-scales optionally including FUNCTYPE, OFM coloring, true RGB image display, and dark vectors in the contours, polarization vectors and stars. KNTR was also changed to plot polarization vectors and to do the full range of gray-scale plotting including all the dark vectors and true- and pseudo-color displays.

The task that makes RGB images from images used as images of intensity, hue, and (optionally) saturation is called TVHUI. It was revised to handle axis increments correctly and to offer the SQ transfer function. RGBMP makes RGB cubes by weighted summing of image planes along the $Z$ axis. It had an addressing error that caused it to weight the red and blue images unequally and it previously ignored the actual direction of the $Z$ axis coordinate so that red and blue had nothing to do with red-shifted and blue-shifted. Those bugs were corrected and a number of experimental methods for doing the summing were added.

The plot rendering tasks TKPL and TXPL were revised to do what little they can do with the new commands. TVPL was changed to implement most of the new commands, giving the user the choice of rendering all dark vectors as black or leaving them bright. Since it puts them in colored graphics overlay planes, they may not require the use of black. TVPL and all plot tasks with DOTV = TRUE were revised to use either a single graphics overlay for all lines and characters or to use graphics overlays 1 through 4 for the four different line types. The usage of line types varies by plot task. As a general rule, type 1 is labeling, type 2 is contours, type 3 is vector drawings such as polarization vectors, and type 4 is for symbols such as stars or visibility samples. LWPLA is the main task for converting plot files to paper, transparencies, and journals. The scaling options for gray-scales were retained, but they will normally not be needed since it is more natural to apply them in the plot tasks. Pseudo-coloring of gray scales was added to LWPLA as was the new adverb DOCOLOR.

If it is true, then the new adverb array PLCOLORS(3,10) is used to color the 4 line types in bright vectors, the 4 line types in dark vectors, the characters drawn outside of the main plot, and the background of the full plot, respectively. Some journals prefer the "CMYK" color representation used in printing to the usual RGB scheme. LWPLA now offers the option to use CMYK rather than RGB, but RGB remains the default since it uses less disk. The positioning of vertical strings by LWPLA was corrected.

All plot tasks had subtle changes made to the spacing of labels and plot borders. POSSM was corrected for residual errors related to plotting multiple IFs and polarizations in a single panel. It was made better at actually stopping when done and at honoring NPLOTS. PROFL was corrected to choose its plot scaling in a way more likely to fill the page and to be less sensitive to certain inevitable plotting errors. UVPLT was given the option to plot both individual samples and binned averages and the DOWEIGHT adverb was added to control the averaging. TVCPS was changed to handle very large images when read from disk.

## UV data handling and calibration

### WIPER

WIPER is a new task to wipe out (flag) bad data using a UVPLT-like display of the data. A circular eraser of user-controlled diameter is used to erase samples from the plot — or to restore previously erased samples. During the interactive phase of the operation, the samples cannot be identified individually, but their coordinates in the two axes of the display are shown. When the interactive session is terminated, a new flag table is created containing all previous flags plus the new, potentially numerous, flags generated by WIPER.

### LOCIT

LOCIT is a new task to solve for antenna locations from an SN table. It works best if a series of observations of calibrators is made with a wide variety of elevations and hour angles. CALIB then finds the SN table for this sequence of scans. LOCIT works by assuming that the phase of each IF is relatively stable and that the phases are mostly due to antenna location errors. Plots and printer displays of the residuals and solutions are available. A new RUN file called BASFIT sets "normal" adverb values for a sequence of CALIB, LOCIT, and LWPLA to be used primarily by the VLA analysts. LOCIT is based on older programs written by Rick Perley and Gustaaf van Moorsel but offers greater maintainability and several new options.

### VLA archive data

The archive of raw VLA data is being placed on-line by the e2e project at the NRAO. The information to select which data you need is available from NRAO's web site and methods to select all data from a specific project are being developed. From the *AIPS* perspective, this development made it desirable to read archive data from disk as well as tape. PRTTP and FILLM have both been revised to read one or more data files from a user-specified disk directory. The file names must all be the same except for an appended "tape-file" number.

A number of generally minor errors in FILLM were corrected while the disk reading was being tested. The most serious was in the handling of ends of file, which could cause the task to get the wrong file number and to fail to stop as requested. Odd conditions on-line could cause FILLM to write fewer channel-0 samples than spectral samples, which was confusing to users. The data in such cases was always bad. History writing was improved as well.

### Other changes

**FITLD** failed to apply the General Relativity correction to source coordinates, giving small errors in the apparent coordinates.

**QUACK** was given the option "TAIL" to flag all sources for a specified time following a scan. This covers the case in which the array thinks it has moved on to the next source but some antennas have not yet gotten the message and so think themselves still on source (actually the last one).

**BPASS** had a serious error which caused it to miss the first record of each SOLINT integration period except the very first. This usually affected one baseline very much more than the rest. An option to rescale the bandpass solutions to correct for the spectral index of the calibrator was added.

**CLCAL** was given adverb DOBLANK to control whether blanked values in an SN table are replaced or left blanked when smoothing is requested.

**UVDIF** was changed to allow checking for differences in weights, to allow the ignoring of flagging differences, and to allow some header differences to be ignored.

**FUDGE** was given the option to scale the visibility amplitudes as it copies the data.

**SPLAT** copied tables for all included IFs even if IF averaging was done and copied the CL table even when it was applied. Dropped the excess parts of the copies.

## VLBA data calibration pipeline

As announced in the previous *AIPSLetter*, the first version of the VLBA Data Calibration Pipeline (RUN file VLBAPIPE) has now been included in the *AIPS* distributions of 31DEC02 and later. Although some anticipated features, such as polarization calibration, are not yet incorporated, this version of the VLBA Data Calibration Pipeline will let you reduce your data almost blindly for most VLBA-only experiments. These include low and high frequency observations, with and without phase-referencing.

A full description of the current status and limitations of the VLBA Data Calibration Pipeline can at all times be obtained from the VLBA astronomer web page
http://www.aoc.nrao.edu/vlba/html/vlbahome/observer.html
under "Calibration and Imaging." This page will be describing new features as the VLBA Data Calibration Pipeline gets updated through the *AIPS* Midnight Job in the 31DEC03 version.

Questions and suggestions are welcome at lsjouwer@aoc.nrao.edu.

## Imaging, modeling, analysis

### IMAGR

IMAGR has been changed to allow up to 4096 fields. This is mostly to allow multiple resolutions while also imaging a large number of facets. IMAGR was changed to tolerate a small number of Clean "errors" in which no pixels get Cleaned for a facet before all images are re-made, often at great expense. The adverb FGAUSS was mishandled, causing the zero-width set of fields to have no flux cutoff. A bug in the histogram handling caused fields that should have been treated as done to be Cleaned one extra time. A serious bug copying Clean boxes to the fields of multiple resolutions was able to mess up all the boxes. We also fixed the selection of which image to display at the start of the Clean.

### Miscellaneous

**VTESS** and other tessellation routines were revised to handle up to 4096 pointings. Some limit larger than 55 was needed to test designs for a compact VLA configuration.

**FFT** was revised to handle large images. It had ignored the *AIPS*-wide maximum image parameter (16384).

**UVCON** was overhauled to simulate mosaic (multiple pointing) observations and the handling of shifts was upgraded to allow very large-angle shifts. The addition of random phases has also been added.

**Phase** shifts for angles greater than 90° were corrected. The existing code was correct for smaller angles but got the wrong sign for a square root for really large angles.

**UVMOD** was corrected to use the standard angular shifts, rather than the now deprecated projected-angle shifts.

**SAD** confused position angles again, effectively swapping the uncertainties in the X and Y positions.

**XMOM** was changed to allow the clip levels to vary spatially as expected from the single-dish beam pattern. This allows XMOM to run on the output of PBCOR with correct frequency-dependent beam patterns.

**HGEOM** and other *GEOM tasks had their work space increased. They should be able to handle images up to 1536 on a side with worst-case rotations.

**PATGN** was given two more patterns to generate, a radial polynomial (RADI) and a polynomial in $X$ and $Y$ (POLY).

### General items

**CookBook** was updated for a changed adverb name (NCHAV) in numerous tasks as well as changes in FILLM, WIPER, INDXR, IMAGR, IMEAN, QUACK, CLCAL, FRPLT, and SG2RUN.

**RENAME** verb had a feature that allowed it to name a MA file the same name as a UV file, thereby confusing quite a number of verbs and tasks.

**Installation** process was improved a bit to make a better recommendation of AP size, to create standard FITS and OFM directories, and to set the start date of the MNJ as it says it will.

**Compile** scripts in Solaris received an option for gcc/g77 that is not fully tested and in Linux for the Intel compiler. The SEARCH script that finds which file to compile was made insensitive to extra dots in the path name.

## Recent *AIPS* and related Memoranda

The following new *AIPS* Memorandum is available from the *AIPS* home page.

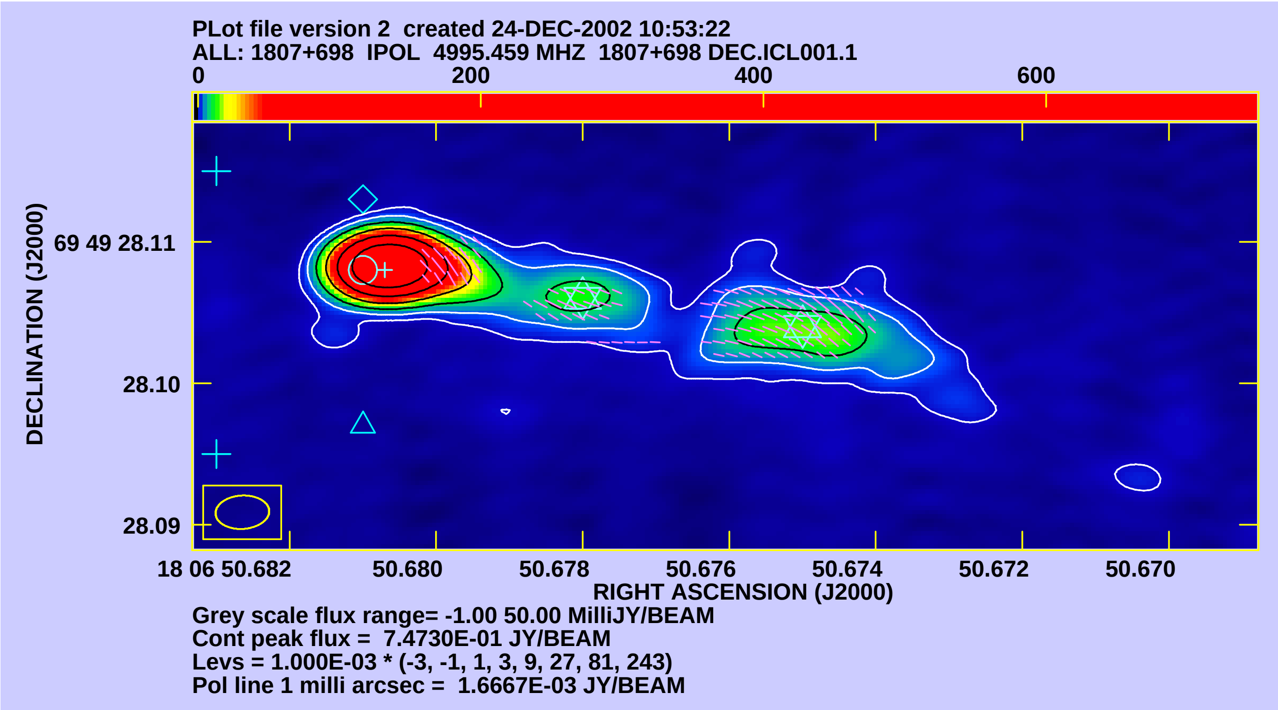
107 KRING versus FRING Tests
Amy J. Mioduszewski (NRAO)
April 8, 2002
This comparison was designed to discover whether KRING or FRING should be used for most, if not all, fringe fitting problems. Within reasonable uncertainty, FRING and KRING performed very similarly. There is some indication that the default signal to noise cutoff in KRING is too low for low signal to noise cases. As one would expect, for high flux density sources the solution interval should be set as low as possible. For low flux density sources the solution interval should be set considering both the ability to find a good solution and to interpolate accurately. The only consistent difference between KRING and FRING is that KRING runs faster than FRING a vast majority of the time, typically by factors of 1.5 to 4.

Readers of the *AIPSLetter* have been informed of the attempt to develop an international standard for the representation of coordinates in FITS over the more than 10 years of that effort. You will be amazed to hear that the first two WCS papers have been published and have been accepted into the FITS standard by the IAU FITS Working Group (following acceptance by the North American, Japanese, and European FITS Committees). Eric Greisen has had two chapters accepted for a book on the history of information processing in astronomy. He also gave an invited paper on Wide-Field Imaging in Classic *AIPS*. All are available from his home page: http://www.aoc.nrao.edu/∼egreisen.

## *AIPS* Distribution

We are now able to log apparent MNJ accesses but have no working tools to count downloads of the tar balls or to manage the registration database. There appear to be about 48 sites/machines running the MNJ at least occasionally.

# Examples of color plotting

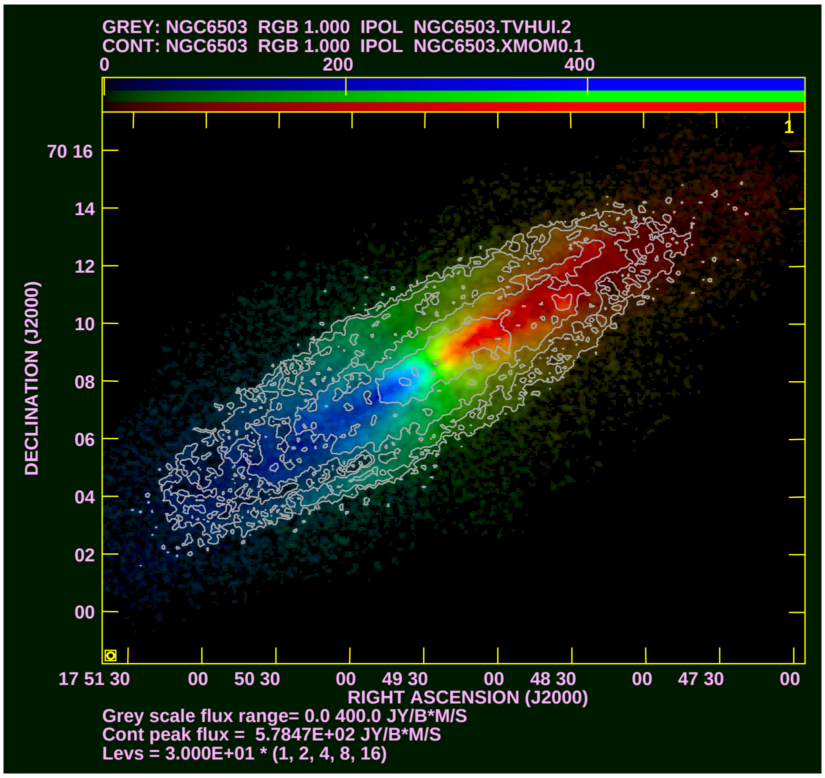



```
KNTR:   Task to generate a plot file for a contour and grey plot
DOCONT        1                  > 0 => do contours
                                 (1 or 2 => which name)
DOGREY        1                  > 0 => do grey scale
                                 (1 pr 2 => which name)
DOVECT        1                  > => do polarization vectors
                                 (1 or 2 => which is IPOL)
                                 Contour or grey or IPOL
INNAME     '1807+698 DEC'        First image name (cube?)
INCLASS    'ICL001'              First image class
INSEQ         1                  First image seq. #
INDISK        3                  First image disk drive #
                                 Polarization intensity image:
IN3NAME    '1807+698 DEC'          (name) blank => INNAME
IN3CLASS   'QCL001'                (class) blank => 'PPOL'
IN3SEQ        1                    (seq. #) 0 => high
IN3DISK       3                    Disk drive #,   0 => any
                                 Polarization angle image:
IN4NAME    '1807+698 DEC'          (name) blank => INNAME
IN4CLASS   'UCL001'                (class) blank => 'PANG'
IN4SEQ        1                    (seq. #) 0 => high
IN4DISK       3                    Disk drive #,   0 => any
PIXRANGE   -1.00E-03     0.05    Min,Max of image intensity
FUNCTYPE   'SQ'                  Image intensity transfer func
OFMFILE    '                                                  '
LTYPE         3                  Type of labeling: 3 standard
DOALIGN       1                  > 0 => images must line up
CLEV        0.001                Absolute value for levs
LEVS         -3           -1     Contour levels (up to 30).
              1            3        9          27
             81          243     *rest 0
FACTOR     1000                  Mult. factor for Pol vector
XINC          3                  X-inc. of Pol vectors. 0=>1
YINC          3                  Y-inc. of Pol vectors. 0=>1
```

```
PCUT         0.001                   Pol. vector cutoff. P units.
ICUT         0.001                   Int. vector cutoff. I units.
DOWEDGE        3                     = 3 => put on top using full
                                            range of image values
STFACTOR       1                     Scale star sizes: 0 => none.
CBPLOT         1                     Position for beam plot:&
                                       1: lower left (default)
DARKLINE      0.33                   Switch to dark lines when
                                     grey-scale > DARKLINE 0-1

LWPLA:   Sends plot file(s) to a PostScript printer or file
INNAME    '1807+698 DEC'             Image name (name)
INCLASS   'ICL001'                   Image name (class)
INSEQ          1                     Image name (seq. #)
INDISK         3                     Disk drive #
PLVER          2                     Version # of PL file. 0=>last
FUNCTYPE  '  '                       'NE','LG','NG', 'SQ', 'NQ'
                                     else linear
DPARM     *all 0                     (1,2) Clip recorded grays
DODARK         1                     Paint dark vectors as "dark"
OFMFILE   'RAINBOW'                  Color grey scales....
DOCOLOR        1                     Use PLCOLORS ?
PLCOLORS       1           1         Line, character, background
               0           1         colors - see HELP.
               1           1            1           0.5
               1           0            1           1
               0           0            0           0
               0           0            0           0
               0           0            0           0
               0           0            0           0.8
               0.8         1
```

KNTR does polarization lines, contours, and grey-scale. Then LWPLA converts the grey-scale to pseudo-color and colors the lines making dark contours dark but dark polarization lines and stars bright.




```
KNTR:  Task to generate a plot file for a contour & grey plot
DOCONT        2                     > 0 => do contours
                                    (1 or 2 => which name)
DOGREY        1                     > 0 => do grey scale
                                    (1 pr 2 => which name)
INNAME      'NGC6503     '          First image name (cube?)
INCLASS     'TVHUI '                First image class
INSEQ         2                     First image seq. #
INDISK        3                     First image disk drive #
                                    Contour or grey or IPOL
IN2NAME     'NGC6503     '          Second image name
IN2CLASS    'XMOMO '                Second image class
IN2SEQ        1                     Second image seq. #
IN2DISK       3                     Second disk drive #
PIXRANGE      0          400        Min,Max of image intensity
FUNCTYPE    'SQ'                    Image intensity transfer func
                                      'SQ' Square root
DOCOLOR       1                     Do RGB images as 3-color?
LTYPE        -3                     Type of labeling: 3 standard
                                    <0 -> no date/time
DOALIGN       1                     > 0 => images must line up
                                       (see HELP DOALIGN)
DOBLANK      -1                     Draw boundary between blanked
                                    areas and good areas?
DOWEDGE       3                     = 3 => put on top using full
                                          range of image values
CBPLOT        1                     Position for beam plot:
                                      1: lower left (default)
DODARK        1                     Plot dark vectors as black?
DARKLINE      0.33                  Switch to dark lines when
                                    grey-scale > DARKLINE 0-1
```

```
LWPLA:    Sends plot file(s) to a PostScript printer or file
INNAME      'NGC6503     '          Image name (name)
INCLASS     'TVHUI '                Image name (class)
INSEQ         2                     Image name (seq. #)
INDISK        3                     Disk drive #
PLVER         2                     Version # of PL file. 0=>last
FUNCTYPE    '  '                    'NE','LG','NG', 'SQ', 'NQ'
                                    else linear
DPARM       *all 0                  (1,2) Clip recorded grays
DODARK        1                     Paint dark vectors as "dark"
OFMFILE     *all ' '                Color grey scales....
DOCOLOR       1                     Use PLCOLORS ?
PLCOLORS      1          1          Line, character, background
              0          0.67       colors - see HELP.
              0.67       0.67          0          0
              0          0             0          0
              0          0             0          0.67
              0.67       0.67          0          0
              0          0             0          0
              1          0.7           1          0
              0.1        0
```

KNTR interprets the output of TVHUI as a three-color RGB image and overlays moment-0 contours. LWPLA adds coloring to the lines, using a less than pure white for both bright and dark contours so that they are not so dominant.

## AIPS Order Form for 31DEC02 (Unix, "tar" format)

*Available under the Free Software Foundation's General Public License*

*Order online:* `http://www.aoc.nrao.edu/aips/forms/aipsorder.html`

*AIPS is available via anonymous ftp at ftp.aoc.nrao.edu/pub/software/aips*

1. Name and address of Contact Person: ____________________

☐ Check here if address on back is ok. ____________________

(Include street address for UPS delivery) ____________________

____________________

2. ☐ New order ☐ ReOrder Do you have an old User Agreement? ☐ Yes ☐ No

Have you registered previously? ☐ Yes ☐ No

(Registration is free to educational/research sites and is required *on every release* for NRAO AIPS support)

3. Media desired: ............. ☐ CDROM (includes Y2K/DDT test package)

☐ Exabyte (5GB) ☐ Exabyte (2.2G)

☐ 4mm DDS DAT

**We reserve the right to institute a media charge at any time**

3a. Binaries on media: ............. ☐ Intel Linux (g77/egcs, glibc)

☐ Sparc Ultra (SUL) 2.6/SC4.2

4. Computer(s) make, model and OS version: ____________________

Include hardware/software/quantity info, e.g. ____________________

Pentium III/Linux 2.2, etc. ____________________

5. Y2K test package: ☐ (includes small, medium, large data sets; FITS tape)

NOTE: Also available via ftp on ftp.aoc.nrao.edu in `/pub/software/aips/FITS/*` and on the CDROM

6. Printed Documents Requested:

☐ AIPS Cookbook (always available at `http://www.aoc.nrao.edu/aips/cook.html`)

☐ Vol 2 ☐ Vol 1 of Going AIPS (15APR90)

☐ paper copy of the Aipsletter (always available at `http://www.aoc.nrao.edu/aips/`)

☐ AIPS Memos: ____________________

See separate list at `ftp://ftp.aoc.nrao.edu/pub/software/aips/TEXT/PUBL/AIPSMEMO.LIST`

*Send this order form (or an electronic equivalent) to:*

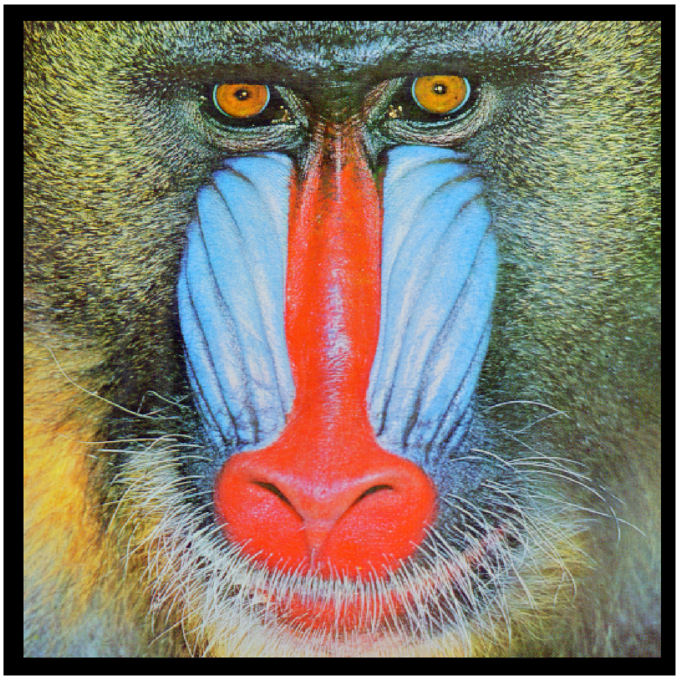
**AIPS Group**
**National Radio Astronomy Observatory**
**520 Edgemont Road**
**Charlottesville, VA 22903–2475**
**USA**

**Network Addresses**

E–Mail: aipsmail@nrao.edu

Web: http://www.aoc.nrao.edu/aips/

Anonymous ftp:
ftp.aoc.nrao.edu/pub/software/aips/



December 31, 2002

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