General purpose IDL functions and procedures.

These are the programs contained within `/gryll/data1/buie/idl` – a collection of general purpose IDL functions and procedures. These routines cover diverse uses from file reading, astronomical data processing, and more.

Here is a list of all routines with their one line descriptions.

2-D plotting

cleandat	Interactive program to eliminate and smooth over bad data points.
focscan	Summarize and plot focus log files from PCCD.
occplot	Plot small pieces of stellar occultation data.
oplerr	Overplot data points with accompanying x or y error bars.
rddat	Display the X and Y value of the cursor in a plot
zplot	Plot differential refraction as a function of wavelength.

Astrometry

ast2ted	Convert astrometry file to a Ted Bowell format astrometry file.
astcol	Collect astrometry observations for multiple objects
asteval	Evaulate an astrometric polynomial function.
astinvrt	Invert an astrometric solution to get x,y given (ξ,η).
astlinks	Scan for linkages among a collection of asteroid astrometric measurements
astlist	Create a summary listing from a final astrometry file.
astpred	Simple asteroid position predictor when no orbit is available.
astprmt	Promote version of an astrometry fit coefficient file to highest version.
astrd2sn	Astrometry conversion from (α,δ) to (ξ,η)
astrd2xy	Astrometry conversion from (α,δ) to image (x,y)
astrepro	Re-reduce existing astrometry originally measured with ASTROM
astrom	Astrometry from a digital image.
astsn2rd	Astrometry conversion from (ξ,η) to (α,δ)
astsolve	Solve for astrometric transformation from image to sky coordinates.
astterms	Evaulate the independent vectors to match an astrometric polynomial function.
astxy2rd	Astrometry conversion from image (x,y) to (α,δ)
ephcheck	Compare a set of astrometry observations against an ephemeris.
frmdxdy	Given two lists of source on field, find the dx,dy offset between lists.
kbompck	Pre-check and summary for MPC data submission for KBO/Centaur observations
linkobj2	Cross check source lists from one field and identify moving objects.
linkobj	Cross check three source lists from one field and identify moving objects.
looker	Visual identification and measurement of moving objects in digital images.
lplastchk	Scan for linkages among a collection of asteroid astrometric measurements
matchup	Read a batch of FITS files and create a list of common object exposures.
mergeobj	Merge a pair of object lists.
moscheck	Scan Mosaic astrometry data and look for inconsistencies and problems
mosplot	Plot Mosaic astrometric solution for DES data and do astrometry.
mpcdcvt	Convert to and from Minor Planet Center packed designation format.
objcheck	Validate and summarize object positions and astrometry
objprmt	Promote version of an object list file to highest version.
objrepor	Generate a report about the contents of the object files in a directory.
plast	Support routine for calling "PLAST" to get asteroids on an image.
plastext	Batch mode extraction of PLAST asteroid lists.
rdoblist	Read a object list from a file.
refext	Batch mode extraction of REFNET star catalog fields in support of ASTROM

(IDL)

refnet	Support routine for calling “REFNET” to get stars from USNO A1.0 catalog.
srcast	Compute ra,dec for all objects in a source list (see findsrc).
wroblist	Write an object list to a file.
xdesig	Digest and record Minor Planet Center designation cross refereces.

Astronomy

addstars	Manipulate the master star catalog (add/replace)
airmass	Compute airmass for one or more times.
altoha	Convert an object altitude to its hour angle.
caldatm	Find year, month, day, hour, minute, second from Julian Date.
decparse	Convert Declination string to radians.
decstr	Convert declination in radians to an ASCII string.
dmstorad	Convert from degrees, minutes, and seconds to radians.
edtcoord	Display a celestial coordinate and permit editing the value.
eph4move	Generates ephemeris files for use by the MOVE computer.
ephem	Ephemeris generator for solar system objects.
fieldobs	Real-time display of where objects are in the sky
findobj	Locate image changes with 3-plane color overlays
futureob	Plot geometric circumstances for a solar system object for some years.
getstars	Retrieve coordinates from the master star catalog
hangle	Compute the local hour angle of an object.
hastr	Convert an Hour Angle to a string.
hatojd	Find the nearest Julian date for a given hour angle and date.
hmstorad	Convert from hours, minutes, and seconds of Right Ascension to radians.
jd2year	Convert Julian date to decimal year.
jdparse	Read and parse a Julian Date from a calendar string
kbolist	Create a summary listing of KBOs in a single directory of DES data
kboplan	KBO observing planning table generation
kbosum	Create a summary listing of KBOs in all directories of DES data
loadstar	Load the master star catalog file
lsidtim	Compute local sidereal time at a given longitude and time.
mag2flx	Convert from magnitudes to flux units with errors.
naifname	Convert an ephem standard name to a common name (NAIF name scheme)
objappul	Generate a list of nightly appulses for a solar system object.
objstars	Get a list of stars from the USNO A2.0 catalog centered on a solar system object.
obsplan	Generate a graphical summary of object location(s) for a given night.
obsprop	Observing proposal planning table generation
obswind	Compute possible observing window for a celestial object.
radtodms	Convert an angle from radians to degrees, minutes, and seconds.
radtohms	Convert from radians to hours, minutes, and seconds of right ascension.
raparse	Convert Right Ascension (RA) string to radians.
rastr	Convert RA in radians to hours, minutes, and seconds (ASCII string).
refrac	Apply atmospheric refraction to a “true” zenith angle
savestar	Save the master star catalog file
showelem	Print out current osculating orbital elements for a solar system object.
ssgeom	Compute Sun and Earth distance and phase angle for solar system object.
sspos	Interactive program for generating solar system body ephemerides.
starcat	Retreive coordinates from the star catalogs.
synstar2	Compute a synthetic (Lorentizian) star image.
tnoobs	Real-time planning and field selection tool for TNO survey observations.

tnorecov	Real-time planning and field selection tool for TNO survey observations.

CCD data processing

acre	Automatic Cosmic Ray Extraction
autocal	Automatic program for creating CCD calibration files.
avgclip	Average over a 3-D array, clipping unusual deviants.
backsub	Background subtraction from an image.
basphote	Circular aperture photometry extraction from images.
bildmask	Stack a set of bad pixel mask images into one master mask.
boxm	Find location of a maximum within a sub-array.
calibchg	Calibration structure maintenance utility.
calval	Validate overscan, cropping region, and calibration file settings.
ccdcal	Batch mode image calibration program (apply bias, dark and flats)
ccdgain	Extract and plot CCD gain transfer curve from flat field image data.
ccdproc	Apply standard CCD image correction steps to a raw image.
centrod	Compute center of mass of an object aperture.
cgetrng	How to integrate over a circle.
clean	Remove a PSF from an image via the "clean" algorithm.
colbias	Determine and subtract column-wise overscan correction with cropping.
darkadj	Adjust a superdark CCD calibration frame by a multiplicative constant.
findsrc	Automatic source detection and photometry from a digital image.
fitsbin	Software binning of an image in FITS file format.
fixsnap	Munge a SNAPSHOT format "FITS" header and make it legal FITS
fxtm	Fix bad time codes from Anderson Mesa CCD software.
getannul	Extract an annulus from a 2-D array.
gridwt	Compute circle overlap weights in a circle within an array.
imqual	Generate a "grade" for image quality of input image.
juploc	Find and extract Jupiter in images and create PDS FITS headers on output.
ldcalib	Load calibration frames and information as instructed by calib file.
limbcen	Find center of body from centroid of limb points (Designed for Jupiter).
maxloc	Find the column-wise, row-wise, or point location of the image maximum.
medarr_mwb	Combine arrays with a median average.
mkbias	Collect and combine CCD bias frames into a superbias frame
mkcalib	Interactive program for creating CCD calibration files.
mkdark	Collect and combine CCD dark frames into a superdark frame
mkflat	Collect and combine CCD flat frames into a superflat frame
mknicsky	Create a master sky image from a set of dithered NICMOS images.
mmaspli	Splice WIYN MMA images back together.
moscal	Apply standard CCD image correction steps to a raw group-FITS image.
p6model	Generate synthetic PSF images for the HST Planetary Camera, Chip 6.
parsekey	Extract FITS header information by parsing supplied keys
pickim	Interactive program to select best image from cube for SL9 data.
pixwt	Circle-rectangle overlap area computation.
psfstack	Generate an average numerical psf by stacking observed images.
radp	Extract point-wise radial "profile" from image data.
redfits	Apply standard CCD processing steps to a raw CCD image.
ringprof	Compute a surface brightness profile.
sl9proc	Interactive program to process and crop image for SL9 data.
spotrm	Spot remover for images
sumann	Integrate over an annulus.

wrcalb	Save contents of a calibration structure to a file.

Compound Widgets

cw_cpmgr	Interactive sky selection for faint comet photometry (from itool).
cw_ipmgr	Display and edit itool image parameters.
cw_itool	General purpose image display.
cw_osipl	Display the various spectra generated by xdavg
cw_pfile	Widget application for plots and profiles of an image.
cw_pixed	Pixel editor.
cw_ppmgr	Display and edit itool photometry parameters.
cw_tplat	Create a photometry template widget.
cw_tpmgr	Photometry template manager for itool.
it_init	Itool initialization.
it_pplod	Load itool photometry parameters from a file.
it_ppsav	Save itool photometry parameters to a file.

File I/O

delfile	Delete file
exists	Check for file (or directory) existence.
fitsedit	Interactive, widget-based editing of FITS header values.
gxpar	General purpose FITS file header keyword extraction.
hardcopy	Close printer or ps graphics device and spool output.
loadkeys	Load FITS header keyword correspondence list from file.
mkdir	Create a new directory
photprmt	Promote version of a photometry log file to highest version.
rdast	Read final astrometry data file.
rdastfc	Read an astrometry fit coefficient file.
rdat1i	Read and return a one dimensional 2-byte integer vector.
rdat1r	Read and return a one dimensional single precision floating point vector.
rdat2i	Read and return a two dimensional two byte integer vector.
rdat2r	Read and return a two dimensional single precision floating point vector.
rdat2u	Read and return a two dimensional two byte unsigned integer vector.
rdbyt	Read and return a two dimensional byte array from an animation file.
rdctioph	Reads raw card image CTIO photometry data files.
rdflt	Read and return a two dimensional byte array from an animation file.
rdgrab	Read raw binary IRTF-grabber1 format data files.
rdimg	Read and return the two images in an old style MaxEnt map.
rdkeylis	Read a correspondence list file into arrays.
rdland2	Read the Combined Landolt Standard system photometry file.
rdland	Read the Landolt Standards data file.
rdlplast	Read a Bowell format asteroid cross reference file (lplast.xrft)
rdmatch	Read a standard name — non-standard name correspondence file.
rdobjdes	Read in a file in the format of newobj.dat for use
rdobscod	Read standard observatory code data file.
rdoccpht	Read a Occultation Photometer data file.
rdphalt	Reads photometry from an alternate format basphote log file.
rdphocat	Read a photometry standard catalog from a file.
rdphot2	Reads the original BASPHOTC photometry log file.
rdphot3	Reads photometry from a reduced photometry file (see WRPHOT)
rdphot	Reads photometry from a basphotc log file.
rdpricat	Read data from a private star catalog.

rdraw	Read and return a two dimensional byte array from a raw animation file.
rdrawast	Read raw astrometry data file.
rdtbl	Read the data from the table file from one night of OSIRIS observations
wrbophot	Write a simple photometry data file.
wrmatch	Write a standard name — non-standard name correspondence file.
wrphalt	Write a photometry log file.
wrphocat	Write a photometry standard catalog file.
wrphot	Write a standard raw photometry data file (Pluto format).
wrtbl	Update the table file of a night's OSIRIS data

Function fitting

atmofit	Fit 1 or 2 gaussians to an astronomical image that is seeing limited.
edgefit	Fit an edge between two signal levels
fourfit	Fit one or more fourier terms to discrete (periodic) data.
goodpoly	Robust fitting of a polynomial to data.
lcfit	Fit a lightcurve function (Fourier series plus phase coefficient).
lcfitsvd	Fit a lightcurve function (Fourier series plus phase coefficient).
mysvdfit	Perform a general least squares fit with optional error estimates.
plch_fun	Two 2-d gaussian images, support routine for PLCHFIT.
plchfit	Two gaussian fit to an image of the Pluto-Charon system.
rcgfit	Fit a radial gaussian function to the input data (no linear term).
rfgfit	Fit a radial gaussian to the input data (no linear term, width fixed).
rgfit	Fit a radial gaussian function and 2nd order polynominal to the input data.
rqgfit	Fit a radial gaussian function to the input data (no linear term).
slope	Compute slope of a line using part of the data.
star_fun	Single 2-d gaussian image, support routine for STARFIT.
starfit	Single gaussian fit to a stellar image.

Image display

digit	Digitize from a displayed gif file.
hardim	Create a postscript image and/or print from an image.
initvc	Compute unit vectors for a spherical surface map.
itool	General purpose image display (front-end for cw_itool).
negative	Invert the current display lookup table.
render	Render a rectangular projection map to a sphere.
seerad	Display a radial profile at X and Y value of the cursor
skysclim	Compute stretch range for a hard stretch on the background in an image.
wedge	Compute and return a gray scale step wedge.

Mathematical

angsep	Compute the angular distance between two spherical coordinates.
deriver	Compute the step-wise derivative of a function of one variable.
fourfunc	Compute a Fourier series function (called by fourfit)
gauss2d	Compute a two dimensional gaussian within an array.
hgp	Compute a single parameter Henyey-Greenstein phase function.
interp	One dimensional interpolation onto a new x grid (both irregular)
lcfun	Compute a lightcurve function (Fourier series plus phase coefficient).
lcfunf	Compute a lightcurve function (Fourier series plus phase coefficient).
prival	Reduce an angle to its principal value ($0 \leq \Theta < 2\pi$).
rotpoint	Rotate x,y,z point(s) about arbitrary axis.
round	round a floating point number.

salb	Compute single particle scattering albedo.
sshift2d	Shift a 2-D array using a damped sinc function for the fractional part.
synstar	Compute a synthetic (gaussian) star image.
Miscellaneous	
airindex	Compute the real part of the refractive index of air.
bidr2	Compute the bi-directional reflectance (newer Hapke formula). This
bidr	Compute the bi-directional reflectance (old Hapke formula).
colcob	Compute the offset from the center-of-light to center-of-body.
dewp	Compute dew point temperature give temperature and relative humidity
difref	Compute amount of atmospheric refraction relative to 5000 Angstroms.
getsalb	Solve for single scattering albedo given bi-directional reflectance
gpsproc	Process and average a single day GPS record.
hstpsf	Find or create a HST PSF file using Tiny Tim.
logerror	Simplified error logging program.
mapseq	Animate a seqence of PLUTOMEM maps.
plotglob	Plot a globe projection with latitude and longitude lines
pwd	Print current working directory.
readtil	Read and return the two images in a MaxEnt tile map file.
tvmaps	Display a full set of Pluto/Charon model .til maps on the current display.
tvtil	Display a Pluto/Charon .til map as an image on the current display.
Numerical	
avger	Temporal averaging of time-series data.
findmax	Find the interpolated local maximum in a 2-D array.
lowess	Lowess smoothing of data.
sincfltr	Pass 1-d data through a low-pass filter (damped sinc).
sint2d	Sinc interpolation of a 2-D array of data.
sint	Sinc interpolation of a 1-D vector of data.
sinterp4	Four-fold sinc interpolation of a vector of data.
slidefil	Sliding spatial filter on time series data.
sshift	Shift data using a damped sinc function for fractional part.
stats	Compute and print statistics plus plot histogram of data.
Photometry	
colorsol	Find the standard color of an unknown star.
coord	Given a list of names and JD, return coordinates (RA and Dec).
crmatch	Create a standard name — non-standard name correspondence file.
datamon	Summary plot of raw data contained in photometry log file
disphase	Apply distance and phase angle correction to observed magnitudes.
flx2mag	Convert from flux units to magnitudes with errors.
getcolor	Given a list of names and JD, return B-V and V-R colors.
gettran	Find and return transformation solution for a given night and instrument
inst2std	Apply photometric transformation from instrumental to standard mags.
ltcrv2	Photometric lightcurve reductions with known transformation.
ltcrv2c	2-color lightcurve reductions with known transformation.
ltcrv	Photometric lightcurve reductions against a single comparison star.
onchip	Extract and optionally plot differential on-chip photometry.
pdm2	Period search by phase dispersion minimization (χ^2 based)
pdm2dis	Phase disconnect shift search by phase dispersion minimization (θ based).
pdm2shif	Zero-point shift search by phase dispersion minimization (θ based).

pdm	Period search by phase dispersion minimization (θ based).
pdmshif	Zero-point shift search by phase dispersion minimization (θ based).
perser	Automated asteroid period search tool.
phasebin	Compute a phase binned average lightcurve
photred	Reduction of non-variable point source absolute photometry.
plotphot	Plot extinction fits from Tholen's ltcrv program.
plpedit	Interactive editing of photometry data files.
reductor	Automated photometry reduction tool.
rephot	Reprocess photometry data set by re-extracting from images.
starproc	Collect and process final (standard) star photometry
stdcheck	Determine if object is in a given standard catalog.
transf	Determine transformation coefficients from instrumental to standard mags.

Spectroscopy

avgspec	Robust average of a set of 1-D spectra from FITS files.
cavgspec	Robust average of a set of 1-D spectra.
clnspec	Interactive cleaning of bad pixels in an OSIRIS XD spectrum.
clscan	Scan a group of raw OSIRIS XD frames and find rough spectral location.
flagspec	Interactive marking of bad pixels in an OSIRIS XD spectrum.
getpair	Read two OSIRIS XD data files and return the difference strip image.
getspec	Extract a point source spectrum from OSIRIS XD data.
getstrip	Extract a 2-d rectangular strip image from a OSIRIS XD image.
inslit	Compute flux passing through a slit assuming a gaussian image.
lclxtrem	Find local minima or maxima in a 1-d vector.
ldcalir	Load calibration information for OSIRIS XD data from a calib file.
nic1scan	Scan for best spectrum location of a weak-signal NICMOS spectrum.
nic1src	Improved 1 source extraction from single NICMOS Grism image data.
nic2src	Detangle two sources from single NICMOS Grism image data.
nicinit	Extract initial spectrum and profile from NICMOS Grism image data.
nicplot	Create a summary plot of the contents of a NICMOS Grism data structure.
nicprof	Update NICMOS observation structure based on a new centerline.
objratio	Ratio object spectra to one or more comp star spectra.
optspec	Optimal extraction of a point source spectrum from OSIRIS XD data.
osiclean	Automatic cleaning of bad and low signal data from OSIRIS XD spectrum
osidvfit	Find the linear fit coefficients for a spectrum for each order
osislope	Correct an IR OSIRIS spectrum for the slope problem.
osismean	Compute mean of a set of OSIRIS XD spectra.
plotsn	Analyze a vector and retrieve the signal-to-noise ratio.
plotspec	Plot OSIRIS XD spectral data with wavelength scale.
rdnicobs	Read a NICMOS observation set description file.
sigratio	Compute the relative signal level between a set of spectra (1-d vectors).
tblparse	Determine properties and problems from the table file with OSIRIS data
wrcalir	Write calibration information for OSIRIS XD data to a calib file.
xdavg	Interactive tool for combining and correcting OSIRIS XD spectra.
xdspec	End-to-end reduction tool for OSIRIS XD spectral data.

Statistics

meanerr2	Calculate the mean and estimated error for a set of weighted data points
meanerr	Calculate the mean and estimated errors for a set of data points
moment4	Compute various statistical moments of the data.
robomean	Robust statistical moments of the data.

Utility	
addslash	Append a trailing / to string (if needed).
badpar	Validate an input parameter against valid entries.
cputime	Return the accumulated user and system times since an arbitrary time.
display	IDL procedure for initializing the X window display for plotting.
exporter	GUI to facilitate exporting a subset of a night's data.
filecopy	Copy one file to a new place or name.
filemove	Move one file to a new place or name.
intrsect	Find the intersection or its inverse between two arrays.
jdstr	Convert Julian date into an ASCII string.
landscap	Procedure for initializing the PS device for plotting.
matchobj	Find matches for non-standard names in a correspondence list.
maxmin	Return vector [max,min] of input array or vector.
nobname	Replace all blanks in a string with an underscore character.
portrait	IDL procedure for initializing the PS device for portrait mode plotting.
rangepar	Parse a string with numbers and ranges to get an expanded list of numbers.
relpath	Prepend a path to the file name if file starts with +
repchar	Replace a target string with a new string in string or string array.
repwrite	Update file by replacing or adding line of information
setpage	Set size and location of plot on page to center the output.
setusym	Set the user defined symbol to one of many shapes.
setwin	Set current draw window, create if needed.
strb36	Convert an integer into a Base 36 formatted string.
strb62	Convert an integer into a Base 62 formatted string.
tobacksl	Convert forward slash (/) to backslash (\) in string.
Widgets	
calibed	Widget for editing CCD calibration information.
ccdphot	General purpose display and processing of CCD image files (FITS).
garth	Visual inspector of moving target triplet detections.
logmanip	Widget for editing and manipulating photometry log files.
markdata	Widget for marking/unmarking bad data.
picker	Widget for selecting a text item from a list.
qinput	Prompt user for input from a widget.
viewtext	View a string, or string array, of text in a scrollable text widget.
xoracle	Display "oracle" animation image sequences.
xrunplot	Display a complete graphical summary of "plutomem" output logs.

All routines

acre	Automatic Cosmic Ray Extraction
addslash	Append a trailing / to string (if needed).
addstars	Manipulate the master star catalog (add/replace)
airindex	Compute the real part of the refractive index of air.
airmass	Compute airmass for one or more times.
altoha	Convert an object altitude to its hour angle.
angsep	Compute the angular distance between two spherical coordinates.
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astrepro	Re-reduce existing astrometry originally measured with ASTROM
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astsolve	Solve for astrometric transformation from image to sky coordinates.
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atmofit	Fit 1 or 2 gaussians to an astronomical image that is seeing limited.
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avgclip	Average over a 3-D array, clipping unusual deviants.
avger	Temporal averaging of time-series data.
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backsub	Background subtraction from an image.
badpar	Validate an input parameter against valid entries.
basphote	Circular aperture photometry extraction from images.
bidr2	Compute the bi-directional reflectance (newer Hapke formula). This
bidr	Compute the bi-directional reflectance (old Hapke formula).
bildmask	Stack a set of bad pixel mask images into one master mask.
boxm	Find location of a maximum within a sub-array.
caldatm	Find year, month, day, hour, minute, second from Julian Date.
calibchg	Calibration structure maintenance utility.
calibed	Widget for editing CCD calibration information.
calval	Validate overscan, cropping region, and calibration file settings.
cavgspec	Robust average of a set of 1-D spectra.
ccdcal	Batch mode image calibration program (apply bias, dark and flats)
ccdgain	Extract and plot CCD gain transfer curve from flat field image data.
ccdphot	General purpose display and processing of CCD image files (FITS).
ccdproc	Apply standard CCD image correction steps to a raw image.
centrod	Compute center of mass of an object aperture.
cgetrng	How to integrate over a circle.
clean	Remove a PSF from an image via the “clean” algorithm.
cleandat	Interactive program to eliminate and smooth over bad data points.
clnspec	Interactive cleaning of bad pixels in an OSIRIS XD spectrum.

(IDL)

clscan	Scan a group of raw OSIRIS XD frames and find rough spectral location.
colbias	Determine and subtract column-wise overscan correction with cropping.
colcob	Compute the offset from the center-of-light to center-of-body.
colorsol	Find the standard color of an unknown star.
coord	Given a list of names and JD, return coordinates (RA and Dec).
cputime	Return the accumulated user and system times since an arbitrary time.
crmatch	Create a standard name — non-standard name correspondence file.
cw_cpmgr	Interactive sky selection for faint comet photometry (from itool).
cw_ipmgr	Display and edit itool image parameters.
cw_itool	General purpose image display.
cw_osipl	Display the various spectra generated by xdavg
cw_pfile	Widget application for plots and profiles of an image.
cw_pixed	Pixel editor.
cw_ppmgr	Display and edit itool photometry parameters.
cw_tplat	Create a photometry template widget.
cw_tpmgr	Photometry template manager for itool.
darkadj	Adjust a superdark CCD calibration frame by a multiplicative constant.
datamon	Summary plot of raw data contained in photometry log file
decparse	Convert Declination string to radians.
decstr	Convert declination in radians to an ASCII string.
delfile	Delete file
deriver	Compute the step-wise derivative of a function of one variable.
dewp	Compute dew point temperature give temperature and relative humidity
difref	Compute amount of atmospheric refraction relative to 5000 Angstroms.
digit	Digitize from a displayed gif file.
disphase	Apply distance and phase angle correction to observed magnitudes.
display	IDL procedure for initializing the X window display for plotting.
dmstorad	Convert from degrees, minutes, and seconds to radians.
edgefit	Fit an edge between two signal levels
edtcoord	Display a celestial coordinate and permit editing the value.
eph4move	Generates ephemeris files for use by the MOVE computer.
ephcheck	Compare a set of astrometry observations against an ephemeris.
ephem	Ephemeris generator for solar system objects.
exists	Check for file (or directory) existence.
exporter	GUI to facilitate exporting a subset of a night's data.
fieldobs	Real-time display of where objects are in the sky
filecopy	Copy one file to a new place or name.
filemove	Move one file to a new place or name.
findmax	Find the interpolated local maximum in a 2-D array.
findobj	Locate image changes with 3-plane color overlays
findsrc	Automatic source detection and photometry from a digital image.
fitsbin	Software binning of an image in FITS file format.
fitsedit	Interactive, widget-based editing of FITS header values.
fixsnap	Munge a SNAPSHOT format "FITS" header and make it legal FITS
flagspec	Interactive marking of bad pixels in an OSIRIS XD spectrum.
flx2mag	Convert from flux units to magnitudes with errors.
focscan	Summarize and plot focus log files from PCCD.
fourfit	Fit one or more fourier terms to discrete (periodic) data.
fourfunc	Compute a Fourier series function (called by fourfit)
frmdxdy	Given two lists of source on field, find the dx,dy offset between lists.

futureob	Plot geometric circumstances for a solar system object for some years.
fxtm	Fix bad time codes from Anderson Mesa CCD software.
garth	Visual inspector of moving target triplet detections.
gauss2d	Compute a two dimensional gaussian within an array.
getannul	Extract an annulus from a 2-D array.
getcolor	Given a list of names and JD, return B-V and V-R colors.
getpair	Read two OSIRIS XD data files and return the difference strip image.
getsalb	Solve for single scattering albedo given bi-directional reflectance
getspec	Extract a point source spectrum from OSIRIS XD data.
getstars	Retrieve coordinates from the master star catalog
getstrip	Extract a 2-d rectangular strip image from a OSIRIS XD image.
gettran	Find and return transformation solution for a given night and instrument
goodpoly	Robust fitting of a polynomial to data.
gpsproc	Process and average a single day GPS record.
gridwt	Compute circle overlap weights in a circle within an array.
gxpar	General purpose FITS file header keyword extraction.
hangle	Compute the local hour angle of an object.
hardcopy	Close printer or ps graphics device and spool output.
hardim	Create a postscript image and/or print from an image.
hastr	Convert an Hour Angle to a string.
hatojd	Find the nearest Julian date for a given hour angle and date.
hgp	Compute a single parameter Henyey-Greenstein phase function.
hmstorad	Convert from hours, minutes, and seconds of Right Ascension to radians.
hstpsf	Find or create a HST PSF file using Tiny Tim.
imqual	Generate a “grade” for image quality of input image.
initvc	Compute unit vectors for a spherical surface map.
inslit	Compute flux passing through a slit assuming a gaussian image.
inst2std	Apply photometric transformation from instrumental to standard mags.
interp	One dimensional interpolation onto a new x grid (both irregular)
intrsect	Find the intersection or its inverse between two arrays.
it_init	Itool initialization.
it_pplod	Load itool photometry parameters from a file.
it_ppsav	Save itool photometry parameters to a file.
itool	General purpose image display (front-end for cw_itool).
jd2year	Convert Julian date to decimal year.
jdparse	Read and parse a Julian Date from a calendar string
jdstr	Convert Julian date into an ASCII string.
juploc	Find and extract Jupiter in images and create PDS FITS headers on output.
kbolist	Create a summary listing of KBOs in a single directory of DES data
kbompck	Pre-check and summary for MPC data submission for KBO/Centaur observations
kboplan	KBO observing planning table generation
kbosum	Create a summary listing of KBOs in all directories of DES data
landscap	Procedure for initializing the PS device for plotting.
lcfit	Fit a lightcurve function (Fourier series plus phase coefficient).
lcfitsvd	Fit a lightcurve function (Fourier series plus phase coefficient).
lcfun	Compute a lightcurve function (Fourier series plus phase coefficient).
lcfunf	Compute a lightcurve function (Fourier series plus phase coefficient).
lclxtrem	Find local minima or maxima in a 1-d vector.
ldcalib	Load calibration frames and information as instructed by calib file.
ldcalir	Load calibration information for OSIRIS XD data from a calib file.

limbcen	Find center of body from centroid of limb points (Designed for Jupiter).
linkobj2	Cross check source lists from one field and identify moving objects.
linkobj	Cross check three source lists from one field and identify moving objects.
loadkeys	Load FITS header keyword correspondence list from file.
loadstar	Load the master star catalog file
logerror	Simplified error logging program.
logmanip	Widget for editing and manipulating photometry log files.
looker	Visual identification and measurement of moving objects in digital images.
lowess	Lowess smoothing of data.
lplastchk	Scan for linkages among a collection of asteroid astrometric measurements
lsidtim	Compute local sidereal time at a given longitude and time.
ltcrv2	Photometric lightcurve reductions with known transformation.
ltcrv2c	2-color lightcurve reductions with known transformation.
ltcrv	Photometric lightcurve reductions against a single comparison star.
mag2flx	Convert from magnitudes to flux units with errors.
mapseq	Animate a seqence of PLUTOMEM maps.
markdata	Widget for marking/unmarking bad data.
matchobj	Find matches for non-standard names in a correspondence list.
matchup	Read a batch of FITS files and create a list of common object exposures.
maxloc	Find the column-wise, row-wise, or point location of the image maximum.
maxmin	Return vector [max,min] of input array or vector.
meanerr2	Calculate the mean and estimated error for a set of weighted data points
meanerr	Calculate the mean and estimated errors for a set of data points
medarr_mwb	Combine arrays with a median average.
mergeobj	Merge a pair of object lists.
mkbias	Collect and combine CCD bias frames into a superbias frame
mkcalib	Interactive program for creating CCD calibration files.
mkdark	Collect and combine CCD dark frames into a superdark frame
mkdir	Create a new directory
mkflat	Collect and combine CCD flat frames into a superflat frame
mknicsky	Create a master sky image from a set of dithered NICMOS images.
mmaspli	Splice WIYN MMA images back together.
moment4	Compute various statistical moments of the data.
moscal	Apply standard CCD image correction steps to a raw group-FITS image.
moscheck	Scan Mosaic astrometry data and look for inconsistencies and problems
mosplot	Plot Mosaic astrometric solution for DES data and do astrometry.
mpcdcvt	Convert to and from Minor Planet Center packed designation format.
mysvdfit	Perform a general least squares fit with optional error estimates.
naifname	Convert an ephem standard name to a common name (NAIF name scheme)
negative	Invert the current display lookup table.
nic1scan	Scan for best spectrum location of a weak-signal NICMOS spectrum.
nic1src	Improved 1 source extraction from single NICMOS Grism image data.
nic2src	Detangle two sources from single NICMOS Grism image data.
nicinit	Extract initial spectrum and profile from NICMOS Grism image data.
nicplot	Create a summary plot of the contents of a NICMOS Grism data structure.
nicprof	Update NICMOS observation structure based on a new centerline.
nobname	Replace all blanks in a string with an underscore character.
objappul	Generate a list of nightly appulses for a solar system object.
objcheck	Validate and summarize object positions and astrometry
objprmt	Promote version of an object list file to highest version.

objratio	Ratio object spectra to one or more comp star spectra.
objrepor	Generate a report about the contents of the object files in a directory.
objstars	Get a list of stars from the USNO A2.0 catalog centered on a solar system object.
obsplan	Generate a graphical summary of object location(s) for a given night.
obsprop	Observing proposal planning table generation
obswind	Compute possible observing window for a celestial object.
occplot	Plot small pieces of stellar occultation data.
onchip	Extract and optionally plot differential on-chip photometry.
oplerr	Overplot data points with accompanying x or y error bars.
optspec	Optimal extraction of a point source spectrum from OSIRIS XD data.
osiclean	Automatic cleaning of bad and low signal data from OSIRIS XD spectrum
osidvfit	Find the linear fit coefficients for a spectrum for each order
osislope	Correct an IR OSIRIS spectrum for the slope problem.
osismean	Compute mean of a set of OSIRIS XD spectra.
p6model	Generate synthetic PSF images for the HST Planetary Camera, Chip 6.
parsekey	Extract FITS header information by parsing supplied keys
pdm2	Period search by phase dispersion minimization (χ^2 based)
pdm2dis	Phase disconnect shift search by phase dispersion minimization (θ based).
pdm2shif	Zero-point shift search by phase dispersion minimization (θ based).
pdm	Period search by phase dispersion minimization (θ based).
pdmshif	Zero-point shift search by phase dispersion minimization (θ based).
perser	Automated asteroid period search tool.
phasebin	Compute a phase binned average lightcurve
photprmt	Promote version of a photometry log file to highest version.
photred	Reduction of non-variable point source absolute photometry.
picker	Widget for selecting a text item from a list.
pickim	Interactive program to select best image from cube for SL9 data.
pixwt	Circle-rectangle overlap area computation.
plast	Support routine for calling “PLAST” to get asteroids on an image.
plastext	Batch mode extraction of PLAST asteroid lists.
plch_fun	Two 2-d gaussian images, support routine for PLCHFIT.
plchfit	Two gaussian fit to an image of the Pluto-Charon system.
plotglob	Plot a globe projection with latitude and longitude lines
plotphot	Plot extinction fits from Tholen’s ltcrv program.
plotsn	Analyze a vector and retrieve the signal-to-noise ratio.
plotspec	Plot OSIRIS XD spectral data with wavelength scale.
plpedit	Interactive editing of photometry data files.
portrait	IDL procedure for initializing the PS device for portrait mode plotting.
prival	Reduce an angle to its principal value ($0 \leq \Theta < 2\pi$).
psfstack	Generate an average numerical psf by stacking observed images.
pwd	Print current working directory.
qannounc	Scrollable text display widget with true and false response buttons.
qinput	Prompt user for input from a widget.
radp	Extract point-wise radial “profile” from image data.
radtodms	Convert an angle from radians to degrees, minutes, and seconds.
radtohms	Convert from radians to hours, minutes, and seconds of right ascension.
rangepar	Parse a string with numbers and ranges to get an expanded list of numbers.
raparse	Convert Right Ascension (RA) string to radians.
rastr	Convert RA in radians to hours, minutes, and seconds (ASCII string).
rcgfit	Fit a radial gaussian function to the input data (no linear term).

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rdast	Read final astrometry data file.
rdastfc	Read an astrometry fit coefficient file.
rdat1i	Read and return a one dimensional 2-byte integer vector.
rdat1r	Read and return a one dimensional single precision floating point vector.
rdat2i	Read and return a two dimensional two byte integer vector.
rdat2r	Read and return a two dimensional single precision floating point vector.
rdat2u	Read and return a two dimensional two byte unsigned integer vector.
rdbyt	Read and return a two dimensional byte array from an animation file.
rdctioph	Reads raw card image CTIO photometry data files.
rddat	Display the X and Y value of the cursor in a plot
rdflt	Read and return a two dimensional byte array from an animation file.
rdgrab	Read raw binary IRTF-grabber1 format data files.
rdimg	Read and return the two images in an old style MaxEnt map.
rdkeylis	Read a correspondence list file into arrays.
rdland2	Read the Combined Landolt Standard system photometry file.
rdland	Read the Landolt Standards data file.
rdlplast	Read a Bowell format asteroid cross reference file (lplast.xrft)
rdmatch	Read a standard name — non-standard name correspondence file.
rdnicobs	Read a NICMOS observation set description file.
rdobjdes	Read in a file in the format of newobj.dat for use
rdoblist	Read a object list from a file.
rdobscod	Read standard observatory code data file.
rdoccpht	Read a Occultation Photometer data file.
rdphalt	Reads photometry from an alternate format basphote log file.
rdphocat	Read a photometry standard catalog from a file.
rdphot2	Reads the original BASPHOTC photometry log file.
rdphot3	Reads photometry from a reduced photometry file (see WRPHOT)
rdphot	Reads photometry from a basphotc log file.
rdpricat	Read data from a private star catalog.
rdraw	Read and return a two dimensional byte array from a raw animation file.
rdrawast	Read raw astrometry data file.
rdtbl	Read the data from the table file from one night of OSIRIS observations
readtil	Read and return the two images in a MaxEnt tile map file.
redfits	Apply standard CCD processing steps to a raw CCD image.
reductor	Automated photometry reduction tool.
refext	Batch mode extraction of REFNET star catalog fields in support of ASTROM
refnet	Support routine for calling "REFNET" to get stars from USNO A1.0 catalog.
refrac	Apply atmospheric refraction to a "true" zenith angle
relpath	Prepend a path to the file name if file starts with +
render	Render a rectangular projection map to a sphere.
repchar	Replace a target string with a new string in string or string array.
rephot	Reprocess photometry data set by re-extracting from images.
repwrite	Update file by replacing or adding line of information
rfgfit	Fit a radial gaussian to the input data (no linear term, width fixed).
rgfit	Fit a radial gaussian function and 2nd order polynominal to the input data.
ringprof	Compute a surface brightness profile.
robomean	Robust statistical moments of the data.
rotpoint	Rotate x,y,z point(s) about arbitrary axis.
round	round a floating point number.
rqgfit	Fit a radial gaussian function to the input data (no linear term).

salb	Compute single particle scattering albedo.
savestar	Save the master star catalog file
seerad	Display a radial profile at X and Y value of the cursor
setpage	Set size and location of plot on page to center the output.
setusym	Set the user defined symbol to one of many shapes.
setwin	Set current draw window, create if needed.
showelem	Print out current osculating orbital elements for a solar system object.
sigratio	Compute the relative signal level between a set of spectra (1-d vectors).
sincfltr	Pass 1-d data through a low-pass filter (damped sinc).
sint2d	Sinc interpolation of a 2-D array of data.
sint	Sinc interpolation of a 1-D vector of data.
sinterp4	Four-fold sinc interpolation of a vector of data.
skysclim	Compute stretch range for a hard stretch on the background in an image.
sl9proc	Interactive program to process and crop image for SL9 data.
slidefil	Sliding spatial filter on time series data.
slope	Compute slope of a line using part of the data.
spotrm	Spot remover for images
srcast	Compute ra,dec for all objects in a source list (see findsrc).
ssgeom	Compute Sun and Earth distance and phase angle for solar system object.
sshift2d	Shift a 2-D array using a damped sinc function for the fractional part.
sshift	Shift data using a damped sinc function for fractional part.
sspos	Interactive program for generating solar system body ephemerides.
star_fun	Single 2-d gaussian image, support routine for STARFIT.
starcat	Retreive coordinates from the star catalogs.
starfit	Single gaussian fit to a stellar image.
starproc	Collect and process final (standard) star photometry
stats	Compute and print statistics plus plot histogram of data.
stdcheck	Determine if object is in a given standard catalog.
strb36	Convert an integer into a Base 36 formatted string.
strb62	Convert an integer into a Base 62 formatted string.
sumann	Integrate over an annulus.
synstar2	Compute a synthetic (Lorentizian) star image.
synstar	Compute a synthetic (gaussian) star image.
tblparse	Determine properties and problems from the table file with OSIRIS data
tnoobs	Real-time planning and field selection tool for TNO survey observations.
tnorecov	Real-time planning and field selection tool for TNO survey observations.
tobacksl	Convert forward slash (/) to backslash (\) in string.
transf	Determine transformation coefficients from instrumental to standard mags.
tvmaps	Display a full set of Pluto/Charon model .til maps on the current display.
tvtil	Display a Pluto/Charon .til map as an image on the current display.
viewtext	View a string, or string array, of text in a scrollable text widget.
wedge	Compute and return a gray scale step wedge.
wrbophot	Write a simple photometry data file.
wrcalb	Save contents of a calibration structure to a file.
wrcalir	Write calibration information for OSIRIS XD data to a calib file.
wrmatch	Write a standard name — non-standard name correspondence file.
wroblist	Write an object list to a file.
wrphalt	Write a photometry log file.
wrphocat	Write a photometry standard catalog file.
wrphot	Write a standard raw photometry data file (Pluto format).

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wrtbl	Update the table file of a night's OSIRIS data
xdavg	Interactive tool for combining and correcting OSIRIS XD spectra.
xdesig	Digest and record Minor Planet Center designation cross refereces.
xdspec	End-to-end reduction tool for OSIRIS XD spectral data.
xoracle	Display "oracle" animation image sequences.
xrunplot	Display a complete graphical summary of "plutomem" output logs.
zplot	Plot differential refraction as a function of wavelength.