XCov 23 Observing Instructions: KPD 1930+2752

Coordinates:

```
RA  (2000)    19 32 14.9
Dec (2000)   +27 58 35
Magnitude     13.82 (V)
              13.75 (B)
```

Consult the finder charts for more information.

Headquarters:
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   The username for the FTP site and the password is available through email. This information is only available through email because we have had problems with hackers filling the FTP system in the past. This is not an anonymous FTP transfer, so you will need the username and password to upload your data. If you use the FTP option, load your data into the "**wet/incoming/xcov23/**" directory.

2. Via e-mail to: **wet@iitap.iastate.edu**

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PMT observers
Integration times: For telescopes greater than 1m, use a 5 second integration. For telescopes smaller than 1m, use a 10 second integration.
Filters: Use NO filters in any channel.
Guide Stars: Please consult the finder chart. KPD 1930 has several stars of comparable brightness in the field. Record your ch2 offsets and telescope plate scale so we can determine exactly which star was observed.
Sky calibration: Observers who observe the sky continuously in one channel (the usual method for 3-channel photometers) should record sky in all three channels near the ***beginning*** and the ***end*** of each run to permit accurate cross calibration.
Observers with 2 channel photometers should observe a comparison star with the second channel and take sky by moving the telescope. Try to take sky as often as needed, at least once per 1/2 hour, for 4 or 5 good sky points; more are not needed and cause unwanted data gaps in the light curve of the target star. Try not to take sky measurements on a regular cycle, as that creates unwanted periodicity in the data.
Apertures: Please use the smallest aperture consistent with getting data of good quality (e.g. no visible loss of light to the edge of the aperture). A general rule of thumb is to use an aperture approximately 8-10 times the diameter of the seeing disk. Record the size of the aperture (in arcsec) in your observing log.

CCD observers
Calibrations for CCDs: Proper calibration of CCD data is crucial to the success of this campaign. Be sure to take the appropriate calibration frames for every data run on every night. And if in doubt about how many calibration frames to take, remember that it's always better to have too many calibration frames than not enough!

- **Bias frames**: Take at least 10 zero length exposures (or as short an integration time as your system allows) with the shutter closed at the beginning and end of each data run. If it is necessary to adjust your observing system during a data run (such as filling a dewar), then take additional bias frames before and after this change.
- **Dark frames**: Take at least 10 dark frames with the shutter closed at the beginning and end of each data run. The integration time for the dark frames should be as long as the integration for your data frames or flat fields, whichever is longer. If you are using different integration times for different WET targets, then use the **longest** of those times for your dark integration time.
  If possible (likely only on a clouded out night), take a series of long dark exposures (1000s or so) so a comparison of the dark time over the short exposures can be made.
- **Flat fields**: Take at least 10 flat field frames at the beginning of each data run. Choose an exposure time for your flat fields so that the counts for the CCD are about 50% of the saturation level. We leave it to you if you prefer to take sky or dome flats.

Integration times: For telescopes greater than 1m, use a 5 second integration. For telescopes smaller than 1m, use a 10 second integration.
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If these guidelines are problematic, then observers should use their judgement to determine the integration time that gives the best balance between signal to noise ratio, cycle time and duty time.
CCD binning and window: If possible, change the binning of your CCD to decrease readout time, but be sure that there is still sufficient area around the target and comparison stars for aperture extraction. If your CCD software allows you to window the frame (i.e. read out only a portion of the frame), be sure to leave at least two comparison stars in the window, as well as a clear area that can be used for sky calibration.
Filters: Telescopes under 1m should use NO filter. Telescopes over 1m should use a filter if necessary. Use, in order of preference, CuSO4, BG39, BG40 (a 2mm BG40 matches a BG39 but is more durable), and then B as a last resort. A typical B filter consists of a BG39 filter plus a blue cutoff; if you have such a 2 filter combination, then you can just use the BG39 filter. If none of these options are available, then contact HQ for instructions.
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Data format: There is a set format for CCD data submitted to HQ summarized on this page. If you are unable to submit your data in this format, then please contact Reed directly to discuss the format of your submitted data.

Final analysis:

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Reed Riddle
Iowa State University
Department of Physics & Astronomy
Ames, IA 50011
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Please keep a copy of your data and logs in case some mail gets lost.

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wholeearthtelescope@yahoo.com

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Send comments to WETmaster. Last updated on 29 July 2003.

XCov 23 Observing Instructions: G 29-38

Coordinates:

```
RA  (2000)     23 28 47.74
Dec (2000)    +05 14 53.4
Magnitude      13.03 (V)
               13.17 (B)
```

Consult the finder charts for more information.

Headquarters:
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Apertures: Please use the smallest aperture consistent with getting data of good quality (e.g. no visible loss of light to the edge of the aperture). A general rule of thumb is to use an aperture approximately 8-10 times the diameter of the seeing disk. Record the size of the aperture (in arcsec) in your observing log.

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Send comments to WETmaster. Last updated on 29 July 2003.

XCov 23 Observing Instructions: HS 2201+2610

Coordinates:

```
RA  (2000)    22 04 12.0
Dec (2000)   +26 25 07
Magnitude     14.3 (B)
```

Consult the finder charts for more information.

Headquarters:
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WET CCD Data Format

There are many possible output formats from the various CCD photometry extraction routines, but each uses a different format for their output data. It would essentially be impossible for the WET to support all of these different formats; additionally, the variety of formats results in a lack of uniformity in the data submitted to HQ. For these reasons, the WET HQ will support data submitted in one of two formats:

- Standard Quilt 9 format
- WET CCD format described below

Quilt 9 format is used with WET standard PMT photometers, while the CCD format is discussed below. PMT photometers can use the CCD format, and in fact are encouraged to do so, since it passes a comparative wealth of information to HQ.

For any questions about formatting, or how to get your software compliant with the WET format, email Reed Riddle with any questions.

The WET CCD format

The data file is separated into two sections. The first section is a data header, and the second the times and counts from the photometry. The header is based on a keyword system, so items can be sorted into any order, with the exception of the first line which defines the format. Each header line starts with a hash mark (#), followed by a space, the keyword, a colon and the keyword parameters. Header lines must follow this convention, or the data reduction software will be unable to read the lines. Header lines must be no more than 80 characters long. The times and counts follow the header lines, with no blank lines separating the data from the header. Time formats are discussed below; be sure to follow the instructions closely when including times for the data. The counts are the sum of the pixels in each aperture; there should be no scaling, peak fitting or other methods used to determine the counts. There should also not be any conversions to magnitudes, as the WET data reduction does not use magnitudes. It is possible to submit different aperture sizes for each channel (see the APSCALE keyword), but it is best to use uniform apertures for photometry extraction when at all possible.

Header keywords

The keywords for the data file header are included in the following table. Note that there is an explanation for each keyword; be sure that your software uses the keywords appropriately.

Keyword	Values	Description
General keywords		
XQEDDATA	none	All files start with this keyword on the first line.
RUNNAME	text	Name of the data run. If not used, then the run name is presumed to be the name of the submitted file.
OBSERVER	text	The people who gathered the data. Can be entered on one line, or on multiple header lines.
NCHAN	integer	Number of data channels submitted.
NPTS	integer	Number of data points submitted.
FILTER	keyword	Filter used for observations.
COMMENT	text	Comment line. This is good for passing on any information about the run, especially useful stuff. Can be used on multiple lines.
HEADERLINE	text	CCD header line from the FITS file. As with a comment, used to pass information about the run. Can be used on multiple lines.
Observatory keywords		
OBSKEY	text	Observatory/telescope keyword. If this is used, then none of the following items are necessary for the header.
OBSERVATORY	text	The observatory where the telescope is located.
TELESCOPE	text	Telescope used to acquire the data.
LONGITUDE	HH:MM:SS.S	Telescope longitude W of Greenwich, Eng. Use negative numbers for telescopes E. of Greenwich.

LATITUDE	DD:MM:SS.S	Telescope latitude, positive for North and negative for South.
ALTITUDE	meters	Telescope altitude above sea level, in meters.

Object keywords		
OBJKEY	text	Object keyword. If this is used, then none of the following items are necessary for the header.
OBJECT	text	The star that was observed.
OBJCLASS	text	The class of the object observed.
RA	HH:MM:SS.S	Right ascension of star at EPOCH
DEC	DD:MM:SS.S	Declination of star at EPOCH
EPOCH	YYYY.Y	Epoch of object coordinates. This will usually be a standard date (like 2000.0), but can also be the observation epoch. The coordinates MUST match the epoch!

Photometer keywords		
PHOTKEY	text	Photometer keyword. If this is used, then none of the following items are necessary for the header.
PHOTOMETER	text	Name of the photometer used to acquire data
PHOTTYPE	keyword	Type of photometer used. The only two keyword choices are "CCD" or "PMT".
ACQSOFT	text	Data acquisition software.
EXTRSOFT	text	CCD aperture photometry extraction software.

Time keywords		
DATE-OBS	YYYY-MM-DD	Date at start of first integration
TIME-BEG	HH:MM:SS.SSS	Time at start of first integration
DATE-END	YYYY-MM-DD	Date at start of last integration
TIME-END	HH:MM:SS.SSS	Time at start of last integration
EXP-TIME	seconds	Exposure (integration) time
READ-TIME	seconds	CCD readout time (average)
CYC-TIME	seconds	Length of exposure and CCD readout time
DRIFT	seconds	Computer clock drift through the night (compared to a stable clock). Time is drift from start to end of night. The drift is positive if your clock is running fast and negative if your clock is running slow.
TIME-FMT	keyword	The format of the submitted times. Formats are discussed below.

Aperture keywords		
APTYPE	keywords	The type of data in each of the submitted channels. These are marked with keywords and listed in the order of the data channels.
APSHAPE	keyword	The kind of aperture used in the observations.
APSCALE	numerical list	A list of numbers showing the ratios of each aperture if they are not all the same size. They should be related to the target aperture.
APSIZE	pixels	The size of the apertures, in pixels

The following header keywords are **required** to be included in any data file submitted to WET HQ:

- XQEDDATA
- OBSERVER
- FILTER
- DATA-OBS

- TIME-BEG
- EXP-TIME
- TIME-FMT
- APTYPE
- PHOTTYPE
- OBJKEY **or** OBJECT (plus other information if necessary)
- PHOTKEY **or** PHOTOMETER
- OBSKEY **or** TELESCOPE (plus other information if necessary)

Other header keywords may be necessary, depending on the configuration of your observing instrument or extraction software. It is best to include more information than less, as HQ can always use more information when a problem arises with data.

Filters

WET PMT photometers regularly work without filters, as the characteristics of the PMT sensitivity mesh well with the usual WET objects (white dwarfs and other hot subdwarf stars). CCDs gernerally are not as well matched, and the WET has observed other objects that required filters. It is necessary for photometry to know what filters were used, so keywords have been created for them. The keywords in the following table should be entered along with the FILTER header keyword:

```
# FILTER: FILTER_CLEAR
```

In general, the combination of BG39 or BG40 filters (the red cutoff half of a B filter) and a thinned, back illuminated CCD is a good match for the standard WET PMT photometer tubes and sensitivity.

Keywords for the filter	
Keyword	**Matching filter**
FILTER_CLEAR	No filter used, or one that allowed all visible wavelengths of light through.
FILTER_U	Standard Johnson U filter.
FILTER_B	Standard Johnson B filter.
FILTER_V	Standard Johnson V filter.
FILTER_R	Standard Johnson R filter.
FILTER_I	Standard Johnson I filter.
FILTER_BG39	BG39 filter, the red cutoff of a Johnson B filter.
FILTER_BG40	BG40 filter, the red cutoff of a Johnson B filter.
FILTER_OTHER	A different filter was used. A COMMENT line should be added to the header to indicate the filter used in the observations.
FILTER_NONE	No filter was used.

Aperture information

The Quilt9 data format always presumes that the target is in channel 1, the comparison star in channel 2 and the sky in channel 3. This channel ordering is not necessarily going to be the case with a CCD extraction routine, which doesn't really care what the object in the aperture is. For that reason, it is necessary to tell HQ and the reduction software what type of data is in each channel of the data file. This is done with the APTYPE keyword; for the Quilt9 data, the header line would be:

```
# APTYPE: DATA COMP SKY
```

or

```
# APTYPE: D C S
```

This information must be passed to HQ in order for the data reduction to be successful.

The aperture shape isn't necessary for data reduction, but it can be helpful if data artifacts are found. An ANNULAR aperture is likely the ideal, as it gives a sky value for each star that is right next to the star on the CCD, but it isn't always possible to use. When using an ANNULAR aperture, the header should look like:

```
# APSHAPE: ANNULAR
# APTYPE: DATA SKY COMP SKY COMP SKY    (etc)
```

where each SKY channel follows the corresponding DATA or COMP channel.

Detailed aperture information keywords	
Keyword	**Description**
APTYPE: aperture organization	
DATA	The channel with the target light curve. More than one can be in the data, but we usually only have a single target in a WET field.
D	Same as the DATA keyword.
COMP	A comparison star channel.
C	Same as the COMP keyword.
SKY	A sky channel.
S	Same as the SKY keyword.
APSHAPE: the shape of the aperture	
ANNULAR	The data aperture is a circle centered on the object, with a sky channel extracted in an annulus around the data aperture.
"shape"	Text string describing the shape of the aperture if an annular system is not used.

Time formatting

As we don't have a WET CCD photometry extraction routine, it is necessary for each observing site to use their own extraction software. The drawback of this is that each will use a different format for the time of observation. The reduction software takes this into account, with the caveat that **all times that are submitted to HQ are to be Universal Time (UTC) only**. HQ cannot accept JD, HJD, MJD, BJED, local observatory time or any other time format.

The times submitted can be formatted either in the FITS standard format or in a 24 hour clock format. Times can be at the beginning or middle of the exposure integration, or the beginning and end times of an integration can be submitted together. These will be used to find the center of the integration, which is the proper time to use (instead of the center of the integration plus readout cycle). It isn't necessary to have an even time between subsequent start time of images, but it is important that the integration time be the same between images.

The formats below must be followed as they are shown in the examples.

Time formatting keywords		
Keyword	**Description**	**Example**
PMT_SYSTEM	No times are entered, as it is presumed that the times are evenly spaced and the integrations fill the entire time between data points.	
FITS_FORMAT	Standard FITS format times, as seen in CCD image headers. Time at the beginning of the exposure.	2002-05-12T06:00:00.000
UT_ONLY	Universal time only. Time at the beginning of the exposure.	06:00:00.000
MID_EXPOSE_FITS	Standard FITS format times, as seen in CCD image headers. Time at the midpoint of the exposure (not the cycle!).	2002-05-12T06:00:05.000
MID_EXPOSE_UT	Universal time only. Time at the midpoint of the exposure (not the cycle!).	06:05:00.000
START_END	One column of times at the start of exposures, the second at the end. Times are in UT, not FITS format.	06:00:00.000 06:00:10.500

Examples

The following are examples that show how to use the new WET HQ data format. They only show the first three data points, just to give a sample of what the data should looke like.

The minimum data file
This is the format of a file that includes the absolute mimimum information that must be sent to HQ. Note that the

APSHAPE keyword is included because this example uses an ANNULAR aperture; it can be left out otherwise.

```
# XQEDDATA
# DATE-OBS:   2004-02-29
# TIME-BEG:   12:32:43.000
# EXP-TIME:   10.000
# OBSERVER:   Britney Spears
# OBJKEY: pg1336
# OBSKEY: keck1
# PHOTKEY: SP1
# APTYPE: DATA SKY COMP SKY COMP SKY
# APSHAPE:   ANNULAR
# FILTER: FILTER_BG40
# TIME-FMT:   FITS_FORMAT
2004-02-29T12:32:42.500   12147   8490   13181   8654   11881   9002
2004-02-29T12:32:55.000   12199   8422   13177   8621   11923   8887
2004-02-29T12:33:07.500   12307   8448   13123   8633   11874   9028
```

A more complete example
This example includes almost every keyword in the format. The OBSKEY, PHOTKEY and OBJKEY keywords have been left out in order to show the use of the full format, but they can be included as well.

```
# XQEDDATA
# DATE-OBS:   2004-02-29
# TIME-BEG:   12:32:43.000
# DATE-END:   2004-02-29
# TIME-END:   21:52:12.000
# OBSERVER:   Britney Spears
# RUNNAME: brit-0001.dat
# OBJECT:   PG 1336-018
# OBJCLASS: sdB
# RA: 13:38:47.60
# DEC: -02:01:48.7
# EPOCH: 2000.0
# OBSERVATORY: Keck Observatory, Mauna Kea, HI
# TELESCOPE:   Keck I, 10 meters
# LATITUDE: 19:49:42
# LONGITUDE: 155:28:42
# ALTITUDE: 4160
# PHOTOMETER: CCD prototype
# PHOTTYPE:   CCD
# ACQSOFT:   Spears 1.0b12
# EXTRSOFT:   IRAF DAOPHOT
# OBSERVER:   Bob Dylan
# NCHAN: 6
# NPTS: 3562
# FILTER: FILTER_BG40
# APTYPE: ALLSKY
# APSIZE: 10
# APTYPE: DATA SKY COMP SKY COMP SKY
# APSHAPE:   ANNULAR
# EXP-TIME:   10.000
# READ-TIME:   2.500
# CYC-TIME:   12.500
# DRIFT: 12
# TIME-FMT:   FITS_FORMAT
# COMMENT:   Oops, I did it again.....
2004-02-29T12:32:42.500   12147   8490   13181   8654   11881   9002
2004-02-29T12:32:55.000   12199   8422   13177   8621   11923   8887
2004-02-29T12:33:07.500   12307   8448   13123   8633   11874   9028
```

Contact the WETmaster
Last updated on July 7, 2003

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