



TIME

Calculating Besselian Epoch





Calculating Besselian Epoch

Overview

This lesson will show you how to convert your image date to Besselian, which is the recognized standard for Double Stars.



Calculating Besselian Epoch

Method

Per Argyle (Measuring Double Stars), there are two standards: Besselian and Julian with Besselian as a “best” method is used for doubles.

To calculate: You need to know the Julian Date of your observation: <http://aa.usno.navy.mil/data/docs/JulianDate.php>
Also, click on the next slide for an alternative way to find the Julian Date



Calculating Besselian Epoch

To Find Julian Date: Open your image in Maxim. Select “VIEW, FITS HEADER”. The following window will appear. JD is here:

```
Calibrated-T11-boyceastro-WDS 00002-2519-20161019-202153-Luminance-BIN1-E-060-001
FITS Header for Calibrated-T11-boyceastro-WDS 00002-2519-20161019-202153-Luminance-BIN1-E-060-001
View | Edit |
SIMPLE      = T
BITPIX     = 16 / 8 unsigned int, 16 & 32 int, -32 & -64 real
NAXIS      = 2 / number of axes
NAXIS1     = 4000 / fastest changing axis
NAXIS2     = 2672 / next to fastest changing axis
BSCALE     = 1.0000000000000000 / physical = BZERO + BSCALE * array_value
BZERO     = 32768.000000000000 / physical = BZERO + BSCALE * array_value
DATE-OBS   = 2016-10-20T02:21:56 / [ISO 8601] UTC date/time of exposure start
EXPTIME    = 6.000000000000E-001 / [sec] Duration of exposure
EXPOSURE   = 6.000000000000E-001 / [sec] Duration of exposure
SET TEMP   = -25.0000000000000000 / CCD temperature setpoint in C
CCD-TEMP   = -25.1250000000000000 / CCD temperature at start of exposure in C
XPXSZ     = 9.000000000000000000 / Pixel Width in microns (after binning)
YPXSZ     = 9.000000000000000000 / Pixel Height in microns (after binning)
XBINNING   = 1 / Binning level along the X-axis
YBINNING   = 1 / Binning level along the Y-axis
XORGSUBF   = 0 / Subframe X position in binned pixels
YORGSUBF   = 0 / Subframe Y position in binned pixels
READOUTM   = 12 MHz / Readout mode of image
FILTER      = Luminance / Filter name
IMAGETYP   = Light Frame / Type of image
SITELAT    = 32.54 13 / Latitude of the imaging location
SITELONG   = 115.71 49 / Longitude of the imaging location
JD         = 2457681.5985648148 / Julian Date at start of exposure
FOCALLEN   = 2280.0000000000000000 / Focal length of telescope in mm
APT DIA    = 508.0000000000000000 / Aperture diameter of telescope in mm
APT AREA   = 202832.99727916719 / Aperture area of telescope in mm^2
SWCREATE   = Maxim DL Version 5.24.140126 OKJRS / Name of software that created the image
SBSTOVER   = SBFITSEXT Version 1.0 / Version of SBFITSEXT standard in effect
OBJECT     = WDS 00002-2519 / Target object name
TELESCOP   = Telescope 11 / Telescope name
INSTRUME   = FLI / Detector instrument name
OBSERVER   = Grady Boyce / Observer name
NOTES     =
FLIPS IAT  =
CSTRETCH   = Medium / Initial display stretch mode
CBLACK     = 194 / Initial display black level in ADUs
CWHITE     = 877 / Initial display white level in ADUs
PREDSIAL   = 100 / Correction to add for zero-based ADU
SWOWNER    = Brad Moore / Licensed owner of software
HISTORY    = Temp: -25C, Exp Time 3s
            USERNAME = boyceastro
            HIERARCH IT telescope = Telescope 11
            HIERARCH I telescopePlateScaleH = 0.813157923498932
            HIERARCH I telescopePlateScaleV = 0.813157923498932
            PA = 270.967503012806
            PERSIDE = WEST
            HISTORY File was processed by PinPoint 5.1.8 at 2016-10-20T02:23:02
```

JD = 2457681.5985648148 / Julian Date at start of exposure



Calculating Besselian Epoch

Method

Next, the Besselian Epoch can be found by:

$$\text{Besselian epoch} = 1900 + (\text{Julian Date} - 2415020.31352) / 365.242198781$$

The Besselian epoch at 1900 is 2415020.31352.

The divisor above is the “true” length of the year in days.

Therefore, the equation is linear from 1900 (midnight 1899) using the Julian epoch for that date (2415020.31352).



Calculating Besselian Epoch

Method

Let's do an example:

1. Image date: November 7, 2016 at 4:00 PM **UTC**. (Note, you need to convert observatory time to UTC)
2. Go to the USNO website (<http://aa.usno.navy.mil/data/docs/JulianDate.php>)
3. Enter the date / time of your observations – it will calculate the Julian Date (JD) and provide this result
 - The Julian date for CE 2016 November 7 04:00:00.0 UT is JD 2457699.666667
4. Plug this value into the equation below:
 - Besselian epoch = $1900 + (2457699.666667 - 2415020.31352) / 365.242198781$, therefore
 - Besselian epoch = $1900 + 116.85111 = 2016.85111$
5. NOTE: Computing the date by counting the days in the year, November 7, 2016 would be 2016.85205. Not very different but not recognized as correct.



Calculating Besselian Epoch

NOTE: On the Boyce-Astro Forums, there is an Excel calculator for this action.

Computing Besselian Epoch	
Enter the Julian date of your image from the FITS Header:	2457713.597141
Input this Besselian Epoch into your paper as the observation date:	2016.8903



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Questions?